PROJECT MANUAL

FOR CONSTRUCTION OF

2024 ADDITION AND RENOVATIONS

NORTH HARRISON ELEMENTARY

Ramsey, Indiana

TowerPinkster

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PROJECT MANUAL

FOR CONSTRUCTION OF

2024 ADDITION AND RENOVATIONS

North Harrison Elementary

Ramsey, Indiana

TowerPinkster

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New Albany, IN 47150
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State Registration Number 10300091

Date: April 03, 2024
File: 23-228.001

INDEX TO SPECIFICATIONS

SECTION 00 11 13 - NOTICE TO BIDDERS

Notice is hereby given that sealed proposals will be received:

BY: North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166

FOR: 2024 Addition and Renovations
North Harrison Elementary
1115 W. Whiskey Run Rd. NW
Ramsey, IN 47166

AT: **North Harrison Middle School** (Cafeteria)
1180 IN-64
Ramsey, IN 47166

UNTIL: 4pm (EST), (project local time)

DATE: Wednesday, April 24, 2024

At which time all proposals will be opened and publicly read aloud.
Proposals received after the hour and date set for receiving of proposals, will be returned unopened.

All work will be awarded under a single General Contract.

Proposals shall be executed on the Contractor's Bid for Public Works, Form 96 (Revised 2013), Parts I and II, in full accordance with the Proposal Documents, which are on file with the Owner and Architect and may be examined by Bidders at the following locations:

North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166
812-347-2407

TowerPinkster
320 Pearl Street, Suite 100
New Albany, IN 47150
812-282-9554 p

PRE-BID CONFERENCE
DATE: Tuesday, April 16, 2024
TIME: 4:00 P.M. Project Local Time
LOCATION: North Harrison Elementary
1115 W. Whiskey Run Rd. NW
Ramsey, IN 47166

All bidders and plan services will have free access to a complete electronic set of Drawings and Specifications.
All bid documents may be downloaded free of charge in electronic PDF format for viewing, printing and distribution to bidders, sub-bidders, suppliers, and reprographics services at the discretion and responsibility of the General Contractors. Bidders shall complete the Plan Holder List form via **www.towerpinkster.com/bid-information**.
Upon completion of the form, bidders will be re-directed to the Project Page where all bid information may be downloaded. Bidders should bookmark this link and www.towerpinkster.com/bid-information for future access.
A list of updated Plan Holders and Addenda will periodically be posted and made available for download.

All General Contractors planning to submit a bid for this project are required to be Registered Plan Holders. Registered Plan Holders are only those who complete the Plan Holder List form via the Architect's website as indicated above. Addenda and any other additional information will be emailed only to these registered plan holders (using the address provided on the Plan Holder List form) as they become available.
Bidders obtaining partial copies of the bid documents from any other source are not Registered Plan Holders and will not be automatically provided with Addenda or other bidding updates as prepared by the Architect.
Non-Registered Plan Holders assume all responsibility for obtaining all necessary information in a timely manner.

General Contractors shall certify on the Proposal Form that they have obtained a complete set of construction documents, including all Drawings, Specifications and Addenda, and have reviewed the jobsite to sufficiently familiarize themselves with the existing conditions.

All questions and requests for substitutions shall be directed to:

Heather Graninger
TowerPinkster
Heather.Graninger@TowerPinkster.com

Bid Security in the amount of five percent (5%) of the Proposal, including all add alternates must accompany each Proposal in accordance with the Instructions to Bidders.

The Owner reserves the right to accept or reject any bid and to waive any irregularities in bidding.
The Base Bid may be held for a period not to exceed Forty-Five (45) days before awarding Contracts.
All additive Alternate Bids may be held for a period not to exceed Thirty (30) days after signing of Contract.

Should a successful Bidder withdraw his bid, or fail to execute a satisfactory contract within ten (10) days after notice of acceptance of his bid, the Owner may declare the Bid Security forfeited as liquidated damages, not as penalty.

The successful Bidder shall furnish a Performance Bond and Labor and Materials Payment Bond in an amount equal to one hundred percent (100%) of the Contract Sum with an approved surety company and said bond shall remain in full force and effect for a period of one (1) year after date of final acceptance of the work. The cost of all bonds shall be included in the bid price.

NORTH HARRISON COMMUNITY SCHOOL CORPORATION
APRIL 3, 2024

END OF SECTION 00 11 13

AIA® Document A701™ – 2018

Instructions to Bidders

for the following Project:
(Name, location, and detailed description)

2024 Addition and Renovations
North Harrison Elementary
1115 W. Wiskey Run Rd. NW
Ramsey, IN 47166

THE OWNER:
(Name, legal status, address, and other information)

North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166
Telephone Number: 812.347.2407

THE ARCHITECT:
(Name, legal status, address, and other information)

TowerPinkster Titus Associates, Inc.
320 Pearl Street, Suite 100
New Albany, IN 47150
Telephone Number: 812.282.9554

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall obtain Bidding Documents.)

All bid documents may be downloaded free of charge in PDF format via the Architect's website as identified in the Notice To Bidders. Any/all desired printing of bid documents, including all costs associated therewith, is to be

borne by the bidders. The Architect retains all copyright to all Bid Documents. Bidders may not use the Bid Documents for any purpose except preparing a bid for this project.

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents are also available to download by Sub-bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least seven days prior to the date for receipt of Bids.
(Indicate how, such as by email, website, host site/platform, paper copy, or other method Bidders shall submit requests for clarification and interpretation.)

Requests to the Project Manager(s) listed in the Notice To Bidders may be via email or hard copy letter.

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Substitution Process

§ 3.3.2.1 Written requests for substitutions shall be received by the Architect at least ten days prior to the date for receipt of Bids. Requests shall be submitted in the same manner as that established for submitting clarifications and interpretations in Section 3.2.2.

§ 3.3.2.2 Bidders shall submit substitution requests on a Substitution Request Form if one is provided in the Bidding Documents.

§ 3.3.2.3 If a Substitution Request Form is not provided, requests shall include (1) the name of the material or equipment specified in the Bidding Documents; (2) the reason for the requested substitution; (3) a complete description of the proposed substitution including the name of the material or equipment proposed as the substitute, performance and test data, and relevant drawings; and (4) any other information necessary for an evaluation. The request shall include a statement setting forth changes in other materials, equipment, or other portions of the Work, including changes in the work of other contracts or the impact on any Project Certifications (such as LEED), that will result from incorporation of the proposed substitution.

§ 3.3.3 The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

§ 3.3.4 If the Architect approves a proposed substitution prior to receipt of Bids, such approval shall be set forth in an Addendum. Approvals made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3.5 No substitutions will be considered after the Contract award unless specifically provided for in the Contract Documents.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

(Indicate how, such as by email, website, host site/platform, paper copy, or other method Addenda will be transmitted.)

Email to registered bidders.

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

(Paragraph Deleted)

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by the following bid security:

(Insert the form and amount of bid security.)

Five percent (5%) of Base Bid plus all additive alternates.

§ 4.2.2 The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and shall, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount

of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. In the event the Owner fails to comply with Section 6.2, the amount of the bid security shall not be forfeited to the Owner.

§ 4.2.3 If a surety bond is required as bid security, it shall be written on AIA Document A310™, Bid Bond, unless otherwise provided in the Bidding Documents. The attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of an acceptable power of attorney. The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 4.2.4 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until (a) the Contract has been executed and bonds, if required, have been furnished; (b) the specified time has elapsed so that Bids may be withdrawn; or (c) all Bids have been rejected. However, if no Contract has been awarded or a Bidder has not been notified of the acceptance of its Bid, a Bidder may, beginningForty-Five (45) days after the opening of Bids, withdraw its Bid and request the return of its bid security.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:
(Indicate how, such as by website, host site/platform, paper copy, or other method Bidders shall submit their Bid.)

Two (2) complete paper copies. Electronic copies not accepted.

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted. If a Bid is withdrawn pursuant to this Section 4.4.3, the bid security will be attended to as follows:
(State the terms and conditions, such as Bid rank, for returning or retaining the bid security.)

If the error is mathematical, bid security will be returned in full.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.
(If Payment or Performance Bonds are to be in an amount other than 100% of the Contract Sum, indicate the dollar amount or percentage of the Contract Sum.)

One Hundred Percent (100%)

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.
(Insert the complete AIA Document number, including year, and Document title.)

.4 Drawings

Number	Title	Date

.5 Specifications

Section	Title	Date	Pages

SECTION 00 22 13 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following supplements modify the Instructions to Bidders, AIA Document A701 - 2018, entitled “Instructions to Bidders”. Where a portion of the Instruction to Bidders is modified or deleted by these Supplementary Instructions, the unaltered portions of the Instructions To Bidders shall remain in effect.

ARTICLE 9 - SUPPLEMENTARY INSTRUCTIONS

9.1 Article 3 - BIDDING DOCUMENTS, delete the current Paragraph and replace with the following:
3.1.1 All bid documents may be downloaded free of charge in PDF format via the Architect’s website as identified in the Notice To Bidders. Any/all desired printing of bid documents, including all costs associated therewith, is to be borne by the bidders. The Architect retains all copyright to all Bid Documents. Bidders may not use the Bid Documents for any purpose except preparing a bid for this project.

9.2 Article 3 - BIDDING DOCUMENTS, delete the current Paragraph and replace with the following:
3.1.2 Bid documents are available to sub-bidders in accordance with Paragraph 3.1.1.

9.3 Article 3 - BIDDING DOCUMENTS, add the following Paragraph:
3.1.5 In the event of any discrepancy between electronic versions and any hard copy, printed versions of the files, the hard copy version on file at the Architect’s office will govern.

9.4 Article 3 - BIDDING DOCUMENTS, add the following Paragraph:
3.3.5 When specifications include a list of acceptable manufacturers, it is done for the express purpose of establishing a basis of durability, efficiency, configuration, maintain Owner’s maintenance stock, and not for the purpose of limiting competition. These said names establish the products on which the bidder’s proposal shall be based for that particular specification item. Proposed substitutions must be submitted in accordance with Specification Section 01 62 00 - Product Options and Substitutions.

9.5 Article 3 - BIDDING DOCUMENTS, delete Paragraph 3.4.3.

9.6 Bidder shall submit financial statement demonstrating financial capability to complete project, as required by the Proposal Form.

9.7 Bidder shall submit two (2) copies of all required Bidding Documents.

9.8 All bidders shall submit Contractor’s Bid For Public Works-Form 96, Part I and Part II (Revised 2013), as required by the Proposal Form.

9.9 Bidders are required to include unit prices on added or deleted work as listed on the Contractor’s Bid Form.

9.11 Article 7 – PERFORMANCE BOND AND PAYMENT BOND.
Under Section 7.1.1, delete the words “If stipulated in the Bidding Documents, the” and substitute the word “The”.
Under Section 7.1.1, add the following sentence: “The costs for all Bonds must be included in the bid price.”

Delete Section 7.1.2 in its entirety.

9.12 Materials supplied for this project are exempt from Indiana State Sales Tax.
Products purchased from sources outside the State of Indiana may require payment of sales tax to that particular jurisdiction. All costs for such tax will be the responsibility of the Contractor.

9.13 Electronic submissions of bids are NOT acceptable. This includes fax and e-mail.

END OF SECTION 00 22 13

SECTION 00 41 00 – CONTRACTOR'S BID FORM: PUBLIC WORKS

1.01 PROJECT MANUAL

A. All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. Contractor's Bid Form shall be Contractor's Bid For Public Works-Form 96 (Revised 2013), as modified and as included in Section 00 42 01 and Section 00 42 02.
   1. Part I of Form 96 must be completed as required by statutes.
   2. Part II of Form 96 must be completed as required by statutes only if project is one hundred thousand dollars ($100,000) or more (IC 36-1-12-4).
   3. Proposal form shall be submitted in duplicate (one signed original and one copy).
   4. Forms to be reproductions of those included in Project Manual.
   5. Contractor may bid each, any, or all separate contracts listed.

B. The executed Proposal Form and Non-Collusion Affidavit will become a part of the successful Bidder's Contract Documents.

END OF SECTION 00 41 00

PROPOSAL FORM: PART I
Form 96 (Revised 2013)

CONTRACTOR'S BID FOR PUBLIC WORKS
Prescribed by the State Board of Accounts

CONTRACTORS BID FOR: *2024 ADDITION AND RENOVATIONS*
NORTH HARRISON ELEMENTARY
1115 W. WHISKEY RUN RD. NW
RAMSEY, IN 47166

PART I
(Part I to be completed for all bids)

Date (Month, Day, Year): _____

Governmental Unit (Owner): *NORTH HARRISON COMMUNITY SCHOOL CORPORATION*

County: _____

Bidder (Firm): _____

Address: _____

City, State, Zip: _____

Telephone No.: _____

Fax No.: _____

E-Mail Address: _____

Agent of Bidder: _____
(if applicable)

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of NORTH HARRISON COMMUNITY SCHOOL CORPORATION (Governmental Unit) in accordance with plans and specifications prepared by TowerPinkster and their consultants for the sum of:

BASE BID

Lump Sum _____ $ _____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids apply, the undersigned submits a proposal for each in accordance with the notice.

ADDENDA

Acknowledges receipt of:

Addendum No. _____ ( ) pages Dated _____

Addendum No. _____ ( ) pages Dated _____

Addendum No. _____ ( ) pages Dated _____

Addendum No. _____ ( ) pages Dated _____

ALTERNATES

The undersigned also proposes to furnish or to omit all labor and materials necessary to complete work as required by the Alternate Bids, as provided in the specifications as follows:

Alternate No. 1: *Acoustical Wall Panels* $ _____

Alternate No. 2: *Intercom System Modifications* $ _____

ALLOWANCES

By initialing adjacent to amounts below, bidder acknowledges allowance amounts are included in the forgoing bid:

Contingency Allowance within the **Base Bid** per Section 01 21 13 **$ 325,000.00** initials _____

COMPLETION OF WORK

Undersigned guarantees, if awarded contract, to complete the Phase 1A and 1B work within _____
( ) calendar days.

Undersigned guarantees, if awarded contract, to complete the Phase 2 work within _____
( ) calendar days.

DISCRIMINATION

The Contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment, to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the Contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS *(if applicable)*

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I.C. 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

NON-COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to induce anyone to refrain form bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

GENERAL CONTRACTOR CERTIFICATION

I hereby certify that we have obtained a complete set of construction documents, including all Drawings, Specifications and Addenda, and have reviewed the jobsite to sufficiently familiarize ourselves with the existing conditions.

Dated at _____ this _____ day of _____, 20___.

_____
(Name of Organization)

BY _____

_____
(Title of Person Signing)

OATH AND AFFIRMATION

I hereby affirm under the penalties for perjury that the facts and information contained in the foregoing bid for public works are true and correct.

Dated at _____ this _____ day of _____, 20___.

_____
(Name of Organization)

BY _____

_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF _____

COUNTY OF _____

Before me, a Notary Public, personally appeared the above-named _____ and
(Name of Person Signing)
swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to before me this _____ day of _____, 20 ___.

_____
Notary Public

My Commission Expires:_____

County of Residence: _____

ACCEPTANCE

The above bid is accepted this _____ day of _____, 20___,

subject to the following conditions: _____

_____.

Contracting Authority Members:

_____ _____

_____ _____

_____ _____

END OF SECTION 00 42 01

PROPOSAL FORM: PART II
Form 96 (Revised 2013)

CONTRACTOR'S BID FOR PUBLIC WORKS
Prescribed by the State Board of Accounts

Part II
(Part II to be completed only if project is $100,000 or more - IC 36-1-12-4).

Governmental Unit: *NORTH HARRISON COMMUNITY SCHOOL CORPORATION*

Bidder (Firm): _____

Date: _____

These statements to be submitted under oath by each bidder with and as a part of his bid.
Attach additional pages for each section as needed.

SECTION I: EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

Contract Amount	*Class of Work*	*Completion Date*	*Name and Address of Owner*

2. What public works projects are now in process of construction by your organization?

Contract Amount	*Class of Work*	*Expected Completion Date*	*Name and Address of Owner*

3. Have you ever failed to complete any work awarded to you? _____ If so, where and why?

_____
_____
_____

4. List references from private firms for which you have performed work.

_____
_____
_____

SECTION II: PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work.

_____

_____

_____

_____

2. Please list the names and addresses of all subcontractors that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

_____

_____

_____

_____

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

_____

_____

_____

_____

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

_____

_____

_____

_____

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

_____

_____

_____

_____

SECTION III: CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statue shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

SECTION IV: NON-COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to induce anyone to refrain form bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

SECTION V: OATH AND AFFIRMATION

I hereby affirm under the penalties for perjury that the facts and information contained in the foregoing bid for public works are true and correct.

Dated at _____ this _____ day of _____, 20___.

_____
(Name of Organization)

BY _____

_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF _____

COUNTY OF _____

Before me, a Notary Public, personally appeared the above-named _____ and
(Name of Person Signing)
swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to before me this _____ day of _____, 20 ___.

_____
Notary Public

My Commission Expires:_____

County of Residence: _____

END OF SECTION 00 42 02

SECTION 00 43 13 - BID SECURITY FORM

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. Contractors Bid Security shall be either:
   1. Bid Bond.
   2. Certified Check.
   3. Cashier's Check.

B. The Bid Bond, if used, shall be AIA Document A310 - 2010, entitled "Bid Bond".
   1. Bond shall be by an acceptable Surety Company licensed to do business in the State of **Indiana**.
   2. A copy of this form is bound herewith.

C. Bid Security shall be:
   1. In an amount equal to five (5) percent of the total lump sum base bid plus (5) percent of all add alternates.
   2. Security shall be executed in favor of the Owner.
   3. Should the successful Bidder fail to enter into a contract or furnish the required Bonds within ten (10) days from date of notice of award, the Owner may declare the Bidder's Bid Security forfeited and the Security amount retained by the Owner as liquidated damages.

D. Refer to Section 00 43 93 - Contractor's Bid Submittal Checklist for requirements as to time of submission.

END OF SECTION 00 43 13

AIA® Document A310™ – 2010

Bid Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)
North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)
2024 Addition and Renovations
North Harrison Elementary
1115 W. Whiskey Run Rd. NW
Ramsey, IN 47166

The Contractor and Surety are bound to the Owner in the amount set forth above, for the payment of which the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, as provided herein. The conditions of this Bond are such that if the Owner accepts the bid of the Contractor within the time specified in the bid documents, or within such time period as may be agreed to by the Owner and Contractor, and the Contractor either (1) enters into a contract with the Owner in accordance with the terms of such bid, and gives such bond or bonds as may be specified in the bidding or Contract Documents, with a surety admitted in the jurisdiction of the Project and otherwise acceptable to the Owner, for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or (2) pays to the Owner the difference, not to exceed the amount of this Bond, between the amount specified in said bid and such larger amount for which the Owner may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect. The Surety hereby waives any notice of an agreement between the Owner and Contractor to extend the time in which the Owner may accept the bid. Waiver of notice by the Surety shall not apply to any extension exceeding sixty (60) days in the aggregate beyond the time for acceptance of bids specified in the bid documents, and the Owner and Contractor shall obtain the Surety's consent for an extension beyond sixty (60) days.

If this Bond is issued in connection with a subcontractor's bid to a Contractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

When this Bond has been furnished to comply with a statutory or other legal requirement in the location of the Project, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

Init.
/

furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

Signed and sealed this day of ,

	(Contractor as Principal) *(Seal)*
(Witness)	*(Title)*
	(Surety) *(Seal)*
(Witness)	*(Title)*

SECTION 00 43 36 - SUBCONTRACTOR LIST

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. Successful Bidder for each Contract shall submit his complete Subcontractors List for all trades and divisions of work.

B. After submission of this List and after approval by the Architect/Engineer and Owner, it shall not be changed without written approval by the Owner and Architect/Engineer.

C. Refer to Section 00 43 93 – Contractor's Bid Submittal Checklist for requirements as to time of submission.

1.03 FORM

Provide in Contractor's own format to include the following information:

A. Description of work or trade.

B. Company Name.

C. Company Address.

D. Company Phone and Fax.

E. Contact Person.

F. E-mail Address.

G. MBE/WBE Status.

END OF SECTION 00 43 36

SECTION 00 43 93 – CONTRACTOR'S BID SUBMITTAL CHECKLIST

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Submittals required at time of bid.
   2. Submittals required following bid.

1.02 BID SUBMITTALS

A. The following items are to be submitted by all bidders for all contracts at the time of bidding:
   1. **Proposal Form Parts I and II**
   2. **Bid Security**
   3. **Financial Statement (as required by Proposal Form)**

B. Submit **two** copies (one signed original and one copy) of above information.

1.03 POST-BID SUBMITTALS

A. The following items are to be submitted by each successful bidder for all contracts within Twenty-Four (24) hours following the time of bidding:
   1. **Schedule of Values**
   2. **Subcontractor List**

B. The following items are to be submitted prior to execution of the Owner-Contractor Agreement:
   1. **Performance Bond**
   2. **Labor & Material Payment Bond**
   3. **Certificate of Insurance**
   4. **Indiana Certificate of Qualification for Public Works Projects**
   5. **Signed Escrow Agreement**
   6. **Employee Background Check**
      (per Section 00 73 01-Supplementary General Conditions, Article 13)
   7. **Employee Drug and Alcohol Testing**
      (per Section 00 73 01-Supplementary General Conditions, Article 13)
   8. **Employment Eligibility Verification**
      (per Section 00 73 01-Supplementary General Conditions, Article 13)

C. Submit all above items to Architect for review and approval.

END OF SECTION 00 43 93

SECTION 00 45 46.02 – INDIANA CERTIFICATE OF QUALIFICATIONS FOR PUBLIC WORKS PROJECTS

1.01 PROJECT MANUAL

A. All requirements of the Project Manual apply to this Section.

1.02 SCOPE

A. All contractors shall have Indiana Certificate of Qualification for Public Works Projects per Indiana Code IC 5-16-13 prior to submitting a bid.

B. A “contractor” requiring certification generally refers to a contractor in any contractor tier.
   1. “Tier 1 contractor” has a direct contract with the government agency (Owner). This is also known as the “prime contractor” or “general contractor”.
   2. “Tier 2 contractor” has a direct contract with a Tier 1 contractor. This is also known as a subcontractor.
   3. “Tier 3 contractor” has a direct contract with a Tier 2 contractor. This is also known as a sub-subcontractor.
   4. “Lower tier contractor” has a direct contract with a Tier 3 contractor or lower tier contractor
   5. A supplier or firm not performing any work on site is not required to be qualified.

D. A contractor of any tier is EXEMPT from requirements of this section if the total amount of their work awarded is less than Three Hundred Thousand dollars ($300,000).

1.03 TIER 1 CONTRACTOR

A. Must contribute a minimum of 15% of the initial contract amount by any combination of items 1, 2 or 3 listed below:
   1. Work performed directly by Tier 1 contractor’s employees
   2. Materials supplied directly by Tier 1 contractor
   3. Services supplied directly by the Tier 1 contractor’s employees

1.04 INSURANCE REQUIREMENTS

A. Minimum requirements for each individual or firm in any contractor tier:

B. See Supplementary General Conditions, Section 00 73 01, Article 11

1.05 DRUG TESTING

A. Per Indiana Code, IC-4-13-18
   1. Required of all contractors, regardless of tier.
   2. Written plan for employee drug testing program that complies with IC-4-13-18

1.06 EMPLOYEE VERIFICATION

A. Per Indiana Code, IC-22-5-1.7-3
   1. Required of all contractors, regardless of tier.
   2. Participate in the E-Verify Program

1.07 APPRENTICESHIP & TRAINING PROGRAM

A. Per Indiana Code, IC-5-16-13-12

B. Contractors with 10 or more employees
   1. Provide access to training program applicable to tasks performed in normal course of employment.
   2. Compliance may be accomplished through any of the following:
      a. Apprenticeship program
      b. Programs offered by Ivy Tech Community College of Indiana
      c. Programs offered by Vincennes University
      d. Programs established by or for the contractor
      e. Programs offered by an entity sponsored by the US Dept of Labor
      f. Programs that results in the award of industry recognized portable certification
      g. Programs approved by US Dept of Transportation or INDOT.

C. Tier 1 and tier 2 contractors with 50 or more employees
   1. Must participate in an apprenticeship or training program which meets the standards of any of the following:
      a. The US Department of Labor, Bureau of Apprenticeship and Training
      b. The Indiana Department of Labor
      c. The US Department of Transportation, Federal Highway Administration
      d. INDOT

1.08 RECORDS

A. Per Indiana Code, IC-5-16-13-13

B. Payroll and related records of a contractor in any contractor tier must be:
   1. Preserved by the contractor for a period of three (3) years after completion
   2. Open to inspection by the department of workforce development

END OF SECTION 00 45 46.02

SECTION 00 52 00 - AGREEMENT FORM

1.01 PROJECT MANUAL
All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. The agreement shall be AIA Document A101 - 2017, entitled “Standard Form of Agreement Between Owner and Contractor”.

1. Where the basis of payment is a stipulated sum.
2. Copy of this form is bound herewith.

B. This form, when fully executed, becomes a part of the successful Bidder’s Contract Documents.

END OF SECTION 00 52 00

AIA® Document A101™ – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address and other information)

North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166
Telephone Number: 812.347.2407

and the Contractor:
(Name, legal status, address and other information)

for the following Project:
(Name, location and detailed description)
2024 Addition and Renovations
North Harrison Elementary
1115 W. Whiskey Run Rd. NW
Ramsey, IN 47166

The Architect:
(Name, legal status, address and other information)

TowerPinkster Titus Associates, Inc.
320 Pearl Street, Suite 100
New Albany, IN 47150
Telephone Number: 812.282.9554

The Owner and Contractor agree as follows.

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[ ] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[ ] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- **.1** That portion of the Contract Sum properly allocable to completed Work;
- **.2** That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- **.3** That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- **.1** The aggregate of any amounts previously paid by the Owner;
- **.2** The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;
- **.3** Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;
- **.4** For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and
- **.5** Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
(Insert rate of interest agreed upon, if any.)

%

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

ARTICLE 7 TERMINATION OR SUSPENSION
§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS
§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

§ 8.7 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction

.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
(Insert the date of the E203-2013 incorporated into this Agreement.)

.5 Drawings

Number	Title	Date

.6 Specifications

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

Title	Date	Pages

[ ] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
(Printed name and title)	*(Printed name and title)*

SECTION 00 52 99 - ESCROW AGREEMENT

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. All funds retained by the Owner from approved certificates for payment shall be placed in Escrow per **Indiana** Statutes.

1. Escrow Agreement Form shall be provided by the Escrow Agent and shall be acceptable to both the Owner and the Contractor.

2. Escrow Agreement, when executed shall become a part of the Contract Documents.

3. All escrowed funds shall be deposited in a financial institute as agreed upon by both parties to the Contract.

END OF SECTION 00 52 99

SECTION 00 61 13 – CONTRACTOR'S BOND FOR CONSTRUCTION

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE

A. The Performance Bond and Labor and Material Payment Bond shall be AIA Document A312 - 2010, comprised of two sections entitled "Performance Bond" and "Payment Bond".
   1. Bonds shall be executed by an acceptable Surety Company licensed to do business in the State of **Indiana**.
   2. A copy of this form is bound herewith.

B. Bonds shall be executed in an amount equal to one hundred percent (100%) of the contract amount in favor of the Owner conditioned on the full and faithful performance of the contract and full payment of all obligations arising there under.

C. This form when fully executed becomes a part of the successful bidder's Contract Documents.

END OF SECTION 00 61 13

AIA® Document A312™ – 2010

Performance Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)
North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166

CONSTRUCTION CONTRACT Date:
Amount: $
Description:
(Name and location)
2024 Addition and Renovations
North Harrison Elementary
1115 W. Whiskey Run Rd. NW
Ramsey, IN 47166

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: None See Section 16

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	

(Any additional signatures appear on the last page of this Performance Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Section 3.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after

.1 the Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Section 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

.2 the Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

.3 the Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

§ 4 Failure on the part of the Owner to comply with the notice requirement in Section 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

§ 5 When the Owner has satisfied the conditions of Section 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

§ 5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

§ 5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

§ 5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

§ 5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor and with reasonable promptness under the circumstances:

.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

§ 6 If the Surety does not proceed as provided in Section 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 7 If the Surety elects to act under Section 5.1, 5.2 or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication, for

.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

.2 additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 5; and

.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

§ 8 If the Surety elects to act under Section 5.1, 5.3 or 5.4, the Surety's liability is limited to the amount of this Bond.

§ 9 The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors and assigns.

§ 10 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 11 Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

§ 13 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 14 Definitions

§ 14.1 Balance of the Contract Price. The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

§ 14.2 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

§ 14.3 Contractor Default. Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

§ 14.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 14.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 15 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 16 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

AIA® Document A312™ – 2010

Payment Bond

CONTRACTOR:
(Name, legal status and address)

SURETY:
(Name, legal status and principal place of business)

OWNER:
(Name, legal status and address)
North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)
2024 Addition and Renovations
North Harrison Elementary
1115 W. Whiskey Run Rd. NW
Ramsey, IN 47166

BOND
Date:
(Not earlier than Construction Contract Date)

Amount: $
Modifications to this Bond: None See Section 18

CONTRACTOR AS PRINCIPAL
Company: *(Corporate Seal)*
Signature:

Name and Title:

SURETY
Company: *(Corporate Seal)*
Signature:

Name and Title:

(Any additional signatures appear on the last page of this Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)
AGENT or **BROKER:**

OWNER'S REPRESENTATIVE:
(Architect, Engineer or other party:)

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

§ 1 The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

§ 2 If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

§ 3 If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Section 13) of claims, demands, liens or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials or equipment furnished for use in the performance of the Construction Contract and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety.

§ 4 When the Owner has satisfied the conditions in Section 3, the Surety shall promptly and at the Surety's expense defend, indemnify and hold harmless the Owner against a duly tendered claim, demand, lien or suit.

§ 5 The Surety's obligations to a Claimant under this Bond shall arise after the following:

§ 5.1 Claimants, who do not have a direct contract with the Contractor,

.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

.2 have sent a Claim to the Surety (at the address described in Section 13).

§ 5.2 Claimants, who are employed by or have a direct contract with the Contractor, have sent a Claim to the Surety (at the address described in Section 13).

§ 6 If a notice of non-payment required by Section 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Section 5.1.1.

§ 7 When a Claimant has satisfied the conditions of Sections 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

§ 7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

§ 7.2 Pay or arrange for payment of any undisputed amounts.

§ 7.3 The Surety's failure to discharge its obligations under Section 7.1 or Section 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Section 7.1 or Section 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

§ 8 The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Section 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

§ 9 Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

§ 10 The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to, or give notice on behalf of, Claimants or otherwise have any obligations to Claimants under this Bond.

§ 11 The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders and other obligations.

§ 12 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Section 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 13 Notice and Claims to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

§ 14 When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

§ 15 Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

§ 16 Definitions

§ 16.1 Claim. A written statement by the Claimant including at a minimum:

- **.1** the name of the Claimant;
- **.2** the name of the person for whom the labor was done, or materials or equipment furnished;
- **.3** a copy of the agreement or purchase order pursuant to which labor, materials or equipment was furnished for use in the performance of the Construction Contract;
- **.4** a brief description of the labor, materials or equipment furnished;
- **.5** the date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
- **.6** the total amount earned by the Claimant for labor, materials or equipment furnished as of the date of the Claim;
- **.7** the total amount of previous payments received by the Claimant; and
- **.8** the total amount due and unpaid to the Claimant for labor, materials or equipment furnished as of the date of the Claim.

§ 16.2 Claimant. An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 16.3 Construction Contract. The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

§ 16.4 Owner Default. Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

§ 16.5 Contract Documents. All the documents that comprise the agreement between the Owner and Contractor.

§ 17 If this Bond is issued for an agreement between a Contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

§ 18 Modifications to this bond are as follows:

(Space is provided below for additional signatures of added parties, other than those appearing on the cover page.)

CONTRACTOR AS PRINCIPAL		**SURETY**	
Company:	*(Corporate Seal)*	Company:	*(Corporate Seal)*
Signature:		Signature:	
Name and Title:		Name and Title:	
Address:		Address:	

SECTION 00 72 00 - GENERAL CONDITIONS

1.01 PROJECT MANUAL
All requirements of the Project Manual shall apply to this Section.

1.02 SCOPE
A. The General Conditions shall be AIA Document A201 - 2017, entitled “General Conditions of the Contract for Construction”.

1. A copy of which is bound herewith.

END OF SECTION 00 72 00

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)
2024 Addition and Renovations
North Harrison Elementary
1115 W. Whiskey Run Rd. NW
Ramsey, IN 47166

THE OWNER:
(Name, legal status and address)

North Harrison Community School Corporation
1260 Highway 64 NW
Ramsey, IN 47166

THE ARCHITECT:
(Name, legal status and address)

TowerPinkster Titus Associates, Inc.
320 Pearl Street, Suite 100
New Albany, IN 47150

TABLE OF ARTICLES

ADDITIONS AND DELETIONS:
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

15 CLAIMS AND DISPUTES

INDEX
(Topics and numbers in bold are Section headings.)

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent

consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements,

assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the

Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work
The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights
The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

§ 3.18 Indemnification
§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT
§ 4.1 General
§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract
§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the

Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations

and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor,

prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

.1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and

.2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work,

promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

.1 The change in the Work;
.2 The amount of the adjustment, if any, in the Contract Sum; and
.3 The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

.1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
.2 Unit prices stated in the Contract Documents or subsequently agreed upon;
.3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
.4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

.1 Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;
.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;
.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and
.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will

affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and

unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- **.7** repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;
- **.2** the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and
- **.3** other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures, and utilities not designated for removal, relocation, or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to

the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

.1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;

.2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;

.3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or

.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

.1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;

.2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;

.3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or

.4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

.1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;

.2 Accept assignment of subcontracts pursuant to Section 5.4; and

.3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance,

the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

.1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or

.2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

.1 cease operations as directed by the Owner in the notice;

.2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and

.3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the

Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00 73 01 - SUPPLEMENTARY GENERAL CONDITIONS

Unless otherwise provided in these Supplemental Conditions, all work shall be governed by the terms of AIA Document A201 - 2017, entitled "General Conditions of the Contract for Construction". The following Supplemental Conditions, modify, delete from and add to AIA A201. Where an Article Paragraph, Subparagraph or Clause of AIA A201 is modified, deleted from or added to by these Supplemental Conditions, the unaltered provisions of that Article, Paragraph, Subparagraph or Clause shall remain in full force and effect. To the extent that there is any conflict or ambiguity between AIA A201 and these Supplemental Conditions, then these Supplemental Conditions shall control.

ARTICLE 1 - GENERAL PROVISIONS

1.1.1 THE CONTRACT DOCUMENTS

Add the following:

The Contract Documents also include the following bid documents:
1. Proposal Form (Form 96, Part I and II) – Contractor's Bid for Public Works.

1.1.5 THE DRAWINGS

Add the following Paragraphs:

1.1.5.1 The Drawings are a graphic representation intended to convey the design intent of the Project. They are a 2-dimensional representation of a 3-dimensional Project, and they do not provide a detail for every construction condition of the project. The Drawings are a small-scale representation of complex construction assemblies and components, and not every element of the Project can be indicated in these small scale representations. The Drawings are not an instruction manual, nor are they assembly instructions. They are meant for use by experienced, competent construction professionals with the ability to read, interpret, co-ordinate, interpolate and infer information from them. The Drawings do not indicate every component and assembly necessary to construct the Project. It is the Contractor's responsibility to provide all components and assemblies necessary to provide a safe, complete and finished Project, which is reasonably fit for its intended purpose, whether or not such components and assemblies are detailed on the Drawings.

1.1.5.2 In general, all drawings are diagrammatic and schematic, and cannot indicate every offset, fitting, and accessory, nor can they indicate the field coordination work required to avoid all conflict with other trades. Contractor shall check drawings, shop drawings, and actual equipment of other trades to verify spaces available and make reasonable modifications, as directed, without extra cost to Owner; maintain headroom and other requirements in all areas; and where such requirements appear inadequate, notify Architect/Engineer before proceeding.

1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

Add the following sentence to Paragraph 1.2.1:

It is the Contractor's responsibility to provide all work necessary for a complete and finished Project of first class quality. The Contractor will work skillfully, carefully and will perform in all respects in a workmanlike manner.

Add the following Paragraphs 1.2.2.1 and 1.2.3.1:

1.2.2.1 The Drawings are not intended to define the scope of work among various trades, sub-contractors, material suppliers and vendors. The sheet numbering system is for the convenience of the Architect and the Architect's consultants only, and is not intended to define a sub-contractor's or material supplier's scope of work. Information is detailed, described and located at various locations throughout the Drawings. No consideration will be given to requests for change orders which relate to a failure of the Contractor, or the Contractor's sub-contractors and suppliers to obtain and review a complete set of Contract Documents during bidding, nor to maintain a complete set of Contract Documents during construction. Where bidding is separated into a number of different prime contracts, this paragraph applies to each of the separate prime contracts.

1.2.3.1 In the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following priorities.

1. The Agreement
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Drawings and Specifications.

In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation. The Contractor has a duty to inquire about possible ambiguities and inconsistencies which are patent or obvious during the bidding process and will not receive additional compensation or be excused from resulting difficulties in performance for failure to point out any inconsistencies after that point. In the case of disregard by the Contractor of such inconsistencies and ambiguities, the Architect may require the Contractor to remove and correct work which has been installed at no additional cost to the Owner.

ARTICLE 2 - OWNER

2.3 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.3.4 DELETE Subparagraph 2.3.4 in its entirety and replace with the following:

Neither the Owner nor the Architect shall be liable for inaccuracies or omissions contained in any surveys for the site of the Project, nor shall any inaccuracies or omissions in such items relieve the Contractor of its responsibility to perform the Work in accordance with the Contract Documents.

ARTICLE 3 - CONTRACTOR

3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.4 ADD the following new Subparagraph:

The Contractor shall maintain total control of and shall be fully responsible for the Contractor's employees, agents, representatives, workers, Subcontractors, sub-subcontractors and other such persons or entities, and shall remove from the Site any such persons or entities not in compliance with the Contract Documents as interpreted by the Architect or the Owner. The Contractor shall assure harmonious labor relations at and adjacent to the Site so as to prevent any delays, disruption or interference to the Work. The Contractor shall prevent strikes, sympathy strikes, slowdowns, work interruption, jurisdictional disputes or other labor disputes resulting for any reason whatsoever, from the acts or failure to act, of the employees of the Contractor or any of its Subcontractors material suppliers, or other such persons or entities. The Contractor agrees that it will bind and require all of its

Subcontractors, material suppliers and other such persons or entities to agree to all of the provisions of this subparagraph. If the Contractor or any of its Subcontractors, material suppliers or other such persons or entities fail to fulfill any of the covenants set forth in the Subparagraph, the Contractor will be deemed to be in default and substantial violation of the Contract Documents.

3.5 WARRANTY

Add the following new Subparagraphs 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.5.7, 3.5.8, 3.5.9 and 3.5.10

3.5.3 For a period of one (1) year from the date of Substantial Completion, the Contractor warrants as provided in Subparagraph 3.5.1 and further warrants to the Owner, and the Architect that (a) all movable or adjustable work shall remain in working order, including hardware, doors, windows, apparatus, machinery, mechanical and electrical equipment and (b) the Contractor's portion of the Work shall be waterproof and weatherproof in every respect.

3.5.4 In addition to all the Contractor warranties and obligations to correct defective Work provided by law or as set forth in any of the Contract Documents, the Contractor agrees, upon notice from the Owner or the Architect, to pay for, and if requested, correct, repair, restore and cure any damage or injury, whenever the same shall occur or appear, resulting from any defects, omissions or failure in workmanship or materials, and indemnify, hold harmless, and defend the Owner against any and all claims, losses, costs, damages and expenses, including attorneys' fees, suffered by the Owner as a result of such damage or injury, whenever such damage or injury shall occur or appear.

3.5.5 The commencement and terms of the guarantees and warranties required by the Contract Documents shall not in any manner be affected by any delay in the commencement, progress or completion of the Work, regardless of the cause, therefore.

3.5.6 The foregoing guarantees and warranties shall not shorten any longer warranty or liability period provided for by law or in the Contract Documents or otherwise received from the Contractor or any Subcontractor, material supplier or manufacturer, nor supersede the terms of any special warranty given by the Contractor, nor shorten any period of the Contractor's legal liability for defective Work but shall be in addition thereto.

3.5.7 Notwithstanding anything to the contrary contained herein with respect to warranties, it is understood and agreed that the foregoing warranties and guarantees shall not affect, limit or impair the Owner's right against the Contractor with regard to latent defects in the Work which do not appear within the applicable warranty period and which could not, by the exercise of reasonable care and due diligence, be ascertained or discovered by the Owner within such warranty period. The Contractor shall correct and cure any such latent defects which are reported to the Contractor by the Owner in writing within ninety (90) days after such latent defect first appears or could, by the exercise of reasonable care and due diligence, be ascertained or discovered by the Owner.

3.5.8 Neither the acceptance of any of the Work by the Owner, in whole or in part, nor any payment, either partial or final, by the Owner to the Contractor, shall constitute a waiver by the Owner of any claims against the Contractor for defects in the Work, whether latent or apparent, and no such payment or acceptance of the Work by the Owner shall release or discharge the Contractor of the Contractor's surety, if any, from any such claims for breach of such warranties.

3.5.9 Upon completion of the Work, the Contractor shall furnish the Owner with all written warranties, guarantees, operating manuals, all shop drawings and submittals used in the project relative to equipment installed, and if requested by the Architect, a complete set of reproducible drawings with all field changes noted on them relating to the improvements constructed.

3.5.10 If required by the Owner or the Architect, the Contractor shall deliver to the Owner a signed affidavit stating that the Work has been constructed in accordance with the Contract Documents. If such affidavit is required, final payment or a final certificate for payment shall not be tendered until such affidavit has been delivered to the Owner.

3.6 TAXES

3.6.1 ADD the following new Subparagraph:

Material and properties purchased by contracts with the Owner that become a permanent part of the structure or facilities constructed are not subject to the Indiana Gross Retail Tax (Sales Tax). The Contractor shall obtain a copy of the Owner's exemption certificate and then issue copies of this certificate to his suppliers when acquiring materials and properties for use on the Project. The Contractor shall enforce this exemption clause for his purchases and for those of his Subcontractors.

3.8 ALLOWANCES

Refer to Section 01 21 16- Contingency Allowance for further provisions on this subject.

3.12 SHOP DRAWINGS, PROJECT DATA AND SAMPLES

Refer to Section 01 33 00 - Submittal Procedures for further provisions on this subject.

3.13 USE OF SITE

ADD the following new Subparagraphs 3.13.1 and 3.13.2:

3.13.1 If the Owner requires the contractor to relocate materials or equipment which have been stored on the Site or within the Project, the Contractor shall relocate such materials or equipment at no additional cost to the Owner.

3.13.2 The Contractor is solely responsible for its Site access. The Contractor shall keep all roads, walks, ramps and other areas on and adjacent to the Site in good working order and condition and free from obstructions which might present a hazard to or interference with traffic or the public. When construction operations necessitate the closing of traffic lanes, the Contractor shall be responsible for arranging such closings in advance with the authorities having jurisdiction, the Owner, and adjacent property Owners. The Contractor shall provide adequate barricades, signs and other devices for traffic guides and public safety. Contractor shall maintain all adjacent streets to that Project in a clean condition and shall clean all dirt and mud from the Project and from such adjacent street on a daily basis.

3.14 CUTTING AND PATCHING

Refer to Section 01 73 29 - Cutting and Patching for further provisions on this subject.

3.15 CLEANING UP

Refer to Section 01 74 23 - Cleaning for further provisions on this subject.

ARTICLE 4 – ARCHITECT

4.2 ADMINISTRATION OF THE CONTRACT

ADD the following new Subparagraphs 4.2.2.1:

4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Architect for site visits made necessary by the fault of the Contractor or by defects or deficiencies in the Work.

ARTICLE 6 - CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

6.2 MUTUAL RESPONSIBILITY

ADD the following new Subparagraphs 6.2.6 and 6.2.7:

6.2.6 No Contractor, other Contractor, or Subcontractor, shall be entitled or permitted to sue or make a claim against the Owner or the Architect on account of any delay, disruption or acceleration or damage related thereto. If, however, the Owner or the Architect is sued or receives a claim from a Contractor or other Contractor on account of any alleged delay, disruption, interference or acceleration or damage related thereto caused, or alleged to be caused, in whole or in part, by the Contractor, the Contractor shall defend and indemnify the Owner and the Architect therefore, and reimburse them for their attorney's fees, costs and expenses.

6.2.7 Inasmuch as the completion of the Project within the Contract Time is dependent upon the close and active cooperation of all those engaged therein, it shall be expressly understood and agreed that the Contractor shall lay out and install its Work at such time or times and in such manner as not to delay, interfere, or disrupt the Work of others.

ARTICLE 7 - CHANGES IN THE WORK

7.1 GENERAL

Add the following new Subparagraphs 7.1.4 and 7.1.5:

7.1.4 Consultants to Architect or Owner:

1. Consultants to Architect or Owner shall have NO authority to modify Contract requirements in the Scope of Work or Contract Time.
2. Consultants to Architect or Owner shall have no direct communication with Contractor or subcontractors, suppliers and vendors to Contractor without the express consent of the Architect.
3. Any direct communication authorized by the Architect shall be for clarifications of the Work only and shall not act to authorize any changes in the Scope of Work, Contract Sum or Contract Time.

7.1.5 The overhead, profit and commission percentages included in a Change Order or Construction Change Directive must not exceed the maximums given at the end of this paragraph, and will be considered to include, but not be limited to, insurance (other than Workman’s Compensation Insurance, FICA, Medicare and FUTA), bonds, small tools, incidental job burdens, supervisory expense, project management expense, clerical expense, preparatory expense and general office expense. Workmen’s Compensation Insurance, and employment taxes under FICA, Medicare and FUTA are to be itemized separately and no percentage for overhead, profit and commission will be allowed on them. The percentages for overhead, profit and commission will be negotiated and may vary according to the nature, extent and complexity of the work involved, but not to exceed the maximum percentages shown. Not more than three percentages will be allowed regardless of the number of tiers of sub-contractors; that is, the markup on work subcontracted by a subcontractor will be limited to one overhead percentage and one profit percentage in addition to the prime contractor’s commission percentage. On proposals covering both increases and decreases in the amount of the contract, the overhead, profit, and where applicable, commission, will be computed on the net change only. On proposals for decreases in the amount of the contract, the

overhead and profit shall be added to the decrease in direct cost:

Description	*Overhead*	*Profit*	*Commission*
To Contractor on work performed by other than his/her own forces	0%	0%	10%
To Contractor for that portion of work performed by his/her own forces	10%	10%	0%
To Sub-contractor for that portion of work performed by his/her own forces	10%	10%	0%

7.3 CONSTRUCTION CHANGE DIRECTIVES

Add the following new Subparagraph to 7.3.4.6:

7.3.4.6 Amount for overhead and profit as set forth in this Agreement shall be in accordance with the schedule set forth in Article 7.1.5.

ARTICLE 8 - TIME

8.2 PROGRESS AND COMPLETION

ADD the following Subparagraphs 8.2.4, 8.2.5 and 8.2.6:

8.2.4 Whenever it may be useful or necessary for the Owner to do so, the Owner may take possession of the Project or parts thereof at any time that it is determined by the Architect that the Work has been completed to a point where the Owner may occupy or use said Project, or parts thereof, without interference, delay or disruption to the continued execution of the work. The Owner may at such time install furnishings and equipment as it sees fit or may at its discretion hire other Contractors for this purpose. Such use or occupation shall not relieve the Contractor or these warranty obligations as provided in the Contract Documents nor shorten their commencement dates.

8.2.5 Except as otherwise provided herein, substantial completion of work shall be within the number of calendar days stated by the Contractor on the Proposal Form and shall become a contract obligation. The time for completion of the work shall be extended for the period of any excusable delay, which term shall include only those delays directly caused by any of the reasons enumerated in the following subparagraph 8.3.2 and 8.3.3.

8.2.6 Completion shall be understood to be substantially complete for the Owner’s beneficial occupancy, with only minor Punch List” items yet to be completed and items such as balancing of heating system, etc., which cannot be completed due to climatic conditions.

8.3 DELAYS AND EXTENSIONS OF TIME

DELETE Subparagraph 8.3.1 in its entirety and substitute the following:

8.3.1 If the Work is delayed, disrupted, interfered with our constructively accelerated (hereinafter and collectively referred to as "Hindrance" or "Hindrances") at any time by any act or neglect of the Owner, the Architect, other Contractors or Subcontractors, or any of their employees, or by changes ordered in the Work, fire, unusual delay in transportation, unavoidable casualties, or other cause beyond the

Contractor's control as elsewhere provided in the Contract Documents, then the Contract Time shall be increased by Change Order for such reasonable time as the Architect may determine.

DELETE Subparagraph 8.3.3 in its entirety and substitute the following:

8.3.3 Whether or not any Hindrance shall be the basis for an increase in the Contract Time, the Contractor shall have no claim against the Owner or the Architect for an increase in the Contract Sum, nor a claim against the Owner or the Architect for a payment or allowance of any kind for damage, loss or expense resulting from any Hindrance. As between the Contractor and the Owner, except for acts constituting intentional or grossly unreasonable interference by the Owner or the Architect with the Contractor's performance of the Work when such acts continue after the Contractor's written notice to the Owner of such interference or disruption, the Contractor shall assume the risk of all Hindrances arising from any and all causes whatsoever, including without limitation, those due to any act or omission of the Owner or the Architect, except only to the extent that an increase to the Contract Time may be due to the Contractor as expressly provided for in this Subparagraph. The Contractor shall bear all costs, expenses and liabilities in connection with Hindrances and all costs, expenses and liabilities of any nature whatsoever, whether or not provided for in the Contract Documents, shall conclusively be deemed to have been within the contemplation of the parties. The only remedy available to the Contractor shall be an increase in the Contract Time.

ADD the following new Subparagraphs 8.3.4, 8.3.5 and 8.3.6:

8.3.4 The Owner's exercise of any of its rights under the Contract Documents, including but not limited to its rights regarding changes in the Work, regardless of extent or number of such changes, performance of separate Work or carrying of the Work by the Owner or the Architect, directing overtime or changes in the sequence of the Work, withholding payment or otherwise exercising its rights hereunder, or exercising any of its remedies of suspension of the Work or requirements of correction or re-execution of any defective Work shall not, under any circumstances, be construed as intentional interference or disruption with the Work.

8.3.5 No increase in the Contract Time shall be granted for any Hindrance resulting from unsuitable ground conditions, inadequate forces, the failure of the Contractor to place orders for equipment or materials sufficiently in advance to insure their delivery when needed, or any Hindrance resulting from interruptions to or suspensions of the Work so as to enable others to perform their Work, other than as specifically provided elsewhere in the Contract Documents.

8.3.6 If the Contractor causes a Hindrance to the Work so as to cause any damage to the Owner or any damages for which the Owner may become liable, the Contractor shall be liable therefore and the Owner may withhold from any amount yet due the Contractor the amount reasonably required to compensate the Owner for such damages, if the amount of compensation exceeds the amount yet paid to the Contractor, the Contractor shall pay the difference to the Owner immediately upon demand.

ARTICLE 9 - PAYMENTS AND COMPLETION

9.2 SCHEDULE OF VALUES

Add the following new Subparagraph 9.2.1:

9.2.1 Contractor shall obtain written concurrence in such schedule of values from the Surety furnishing any Performance Bond and Labor and Materials Payment Bond. Copy of written concurrence by the Surety shall be submitted by the time of written submission.

9.3 APPLICATIONS FOR PAYMENT

ADD the following new Subparagraphs: 9.3.1.3, 9.3.1.4, 9.3.1.5, and 9.3.1.6:

9.3.1.3 The Owner will pay ninety-five percent (95%) of the amount due the Contractor on Account of progress payments for the entire period of the Contract.

9.3.1.4 A subcontractor shall be paid ninety-five percent (95%) of the earned sum by the Contractor for the entire period of the Contract.

9.3.1.5 The Owner, Contractor and the Architect/Engineer shall cooperate to the end that retentions shall be paid promptly when all conditions of the Contract have been met.

9.3.1.6 Applications for payment, subsequent to the first application, shall be accompanied by Waivers of Lien from the Contractor and all major subcontractors, suppliers, and vendors.

ADD the following at the end of Subparagraph 9.3.3:

9.3.3 This provision shall not be construed as relieving the Contractor from the sole responsibility and expense for the care and protection of materials and Work upon which payments have been made or the restoration of any stolen, destroyed or damaged Work, or as a waiver of the right of the Owner to require the fulfillment of all of the terms of the Contract Documents.

9.5 DECISIONS TO WITHHOLD CERTIFICATION

ADD the following new Subparagraph 9.5.5:

9.5.5 If any claim or lien is made or filed with or against the Owner, the Architect, the Project, or the Contract Sum by any persons or entity claiming that the Contractor, Subcontractor, or other person for whom the Contractor is responsible has failed to make payment for labor, services, materials, equipment, taxes or other items or obligations furnished or incurred in connection with the Work, or if at any time there shall be any evidence of such non-payment of any claim or lien which is chargeable to the Contractor, or if the Contractor, Subcontractor, or other person or entity for whom the Contractor is responsible caused damage to any Work on the project, or if the Contractor fails to perform or is otherwise in default under any terms or provisions of the Contract, the Owner shall have the right to retain from any payment then due or thereafter an amount which it deems sufficient to (1) satisfy, discharge and/or defend against such claim, lien, or action brought for judgment which may be recovered thereon, (2) make good any such non-payment, damage, failure, or default (3) compensate the Owner and Architect for any and all losses, liabilities, damages, costs, and expenses, including legal fees and costs, which may be sustained or incurred by either or both of them in connection therewith. The Owner shall have the right to apply and charge against the Contractor retained amounts as may be required for these purposes. If the amount retained is insufficient, the Contractor shall be liable for the difference and pay it directly to the Owner.

9.6 PROGRESS PAYMENTS

DELETE Subparagraph 9.6.6 in its entirety and replace with the following:

9.6.6 No recommendation or certification of a progress payment, any progress payment, final payment, or any partial or entire use or occupancy of the Project by the Owner, shall constitute acceptance of any Work

not in accordance with the Contract Documents.

ADD the following new Subparagraph 9.6.8:

9.6.8 On all Contracts totaling two hundred thousand dollars ($200,000.00) or more, an escrow account shall be established in a financial institution, as escrow agent, selected by mutual agreement between the Contractor and the Owner at the time Contracts are executed. The establishing of the escrow account shall be in compliance with the requirement of Indiana Code 36-1-12-14.

1. The Escrow Agent shall invest all escrowed principal in obligations selected by the Escrow Agent.
2. The Escrow Agent shall hold the escrowed principal and income until receipt of notice from the Owner and the Contractor, or the Contractor and the Subcontractor, specifying the part of the escrowed principal to be released from the escrow and to whom that portion is to be released. After receipt of the notice, the Escrow Agent shall remit the designated part of escrowed principal and the same proportion of then escrowed income.
3. The Escrow Agent shall be compensated for its services as the parties may agree in the amount not to exceed fifty percent (50%) of the escrowed income of the escrow amount.
4. See Section 9.10 - Final Completion and Final Payment, for provisions of retainage in escrow and final payment.

9.9 PARTIAL OCCUPANCY OR USE

9.9.1 DELETE the phrase "when such portion is designated by separate agreement with the Contractor" in line 2; DELETE the last two sentences in Subparagraph 9.9.1.

9.10 FINAL COMPLETION AND FINAL PAYMENT

9.10.1 ADD the following sentence at the end of the Subparagraph:

"Provided, however, that final payment shall not be due and payable until sixty-one (61) days after the Work has been completed and the Contract fully performed".

9.10.4 ADD the following at the end of Subparagraph 9.10.4:

"Final payment constituting the unpaid balance of the Contract Sum shall be paid to the Contractor in full, including any retainage *or escrowed principal and escrowed income by the escrow agent*, no less than sixty-one (61 days) following the date of substantial completion. If at any of that time there are any remaining uncompleted items, an amount equal to two hundred percent (200%) of the value of each item as determined by the Architect shall be withheld until said items are completed and a Final Certificate of Payment is issued by the Architect".

DELETE Subparagraph 9.10.5 in its entirety and replace with the following:

9.10.5 The Contractor's obligation to perform the Work and complete the Project in accordance with the Contract Documents shall be absolute. Neither approval of any progress or final payment, nor the issuance of a Certificate of Substantial Completion, nor any payment by the Owner to the Contractor under the Contract Documents, nor any use or occupancy of the Project or any part thereof by the Owner, nor any act of acceptance by the Owner shall constitute an acceptance of Work not in accordance with the Contract Documents, nor does it constitute a waiver of any claims that arise from: (1) liens, claims, security interests or encumbrances arising out of the contract or settled; or (2) terms of any warranties in favor of

the Owner that are provided pursuant to the Contract Documents or otherwise.

ARTICLE 10 - PROTECTION OF PERSONS AND PROPERTY

DELETE Subparagraph 10.1 in its entirety and replace with the following:

10.1 The Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work and in connection with the Contractor's performance of any work other than the Work.

10.2 SAFETY OF PERSONS AND PROPERTY

10.2.1 REPLACE the words "reasonable" with the phrase "all necessary" in both instances in line 1.

ADD the following to Subparagraph 10.2.1:

.4 Protect excavation, trenches, buildings and grounds from all water damage. Furnish necessary equipment to provide this protection during the term of the Contract. Construct and maintain necessary temporary drainage to keep excavations free of water.
.5 Provide protection of the Work against wind, storms, cold and heat. At the end of each day, cover new Work which may be damaged;
.6 Provide adequately-engineered shoring and bracing required for safety and for the proper execution of the Work and have same removed when the Work is completed; and
.7 Protect, maintain and restore benchmarks, monuments and other reference points affected by the Work. If benchmarks, monuments or other reference points are displaced or destroyed, points shall be re-established and markers reset under the supervision of a licensed surveyor, who shall furnish certificates of its work.

10.2.5 INSERT the work "solely" after the word "loss" in the clause which reads "except damage or loss attributable to acts or omissions of the Owner or Architect...".

ADD the following new Subparagraphs 10.2.9, 10.2.10 and 10.2.11:

10.2.9 "The Project is designed to be self-supporting and stable after the Work is fully completed. Except as otherwise provided, it is solely the Contractor's responsibility to determine erection procedures and sequences, and to ensure the safety of the Project and its component parts during erection. This includes, but is not limited to, the addition or modification of whatever temporary bracing, guys or tie downs may be necessary. Such material shall be removed after completion of the Work".

10.2.10 The Contractor shall conform with the United States Department of Labor and the State Division of Labor Occupational Safety and Health Administration regulations.

10.2.11 The Contractor shall have the Hazard Communication Program in effect with all their personnel working on the project. All Material Data sheets should be current as required by law.

ARTICLE 11 - INSURANCE AND BONDS

11.1 CONTRACTOR'S INSURANCE AND BONDS

11.1.1 ADD the following at the end of the subparagraph:
.1 The form of such bonds shall be acceptable to Owner and in compliance with **Indiana** Statute:
.2 The Bonds shall remain in effect for a period of not less than one (1) year following the date of

Substantial Completion and/or time required to resolve any items of incomplete Work and the payment to any owed amounts, whichever time period extends the longer.

.3 The amount of the Performance Bond and the Labor and Material Bond shall each be 100% of the Contract Sum; and

.4 The Contractor shall require the attorney in fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his power of attorney indicating the momentary limit of such power.

.5 The required insurance shall be written for not less than the limits stated in the Owner's Instructions to the Architect (AIA Document G612, Part B) as included in the Project Manual or as required by law, whichever is greater and with the Owner, Architect, Consultants, and Engineers or their assigned names as "Additional Insureds" "Primary" on the insurance policy. Coverages shall be maintained without interruptions from date of commencement, of the work, until date of final payment and termination of any coverage required to be maintained after final payment.

Add the following new Subparagraph 11.1.5 and 11.1.6:

11.1.5 The Contractor shall furnish one copy of Certificate of Insurance and Bonds required of each copy of the agreement, which shall specifically set forth evidence of all coverages required. Furnish Owner copies of any endorsements subsequently issued amending coverage limits.

11.1.6 The Contractor shall keep the surety informed of the progress of the Work, changes in the Work, requests for release of retainage, request for final payment and any other information required by the surety.

11.2 OWNER'S INSURANCE

11.2.1.1 Any errors and omissions insurance maintained by the Architect or the Architect's Consultants shall not serve to exclude the Architect or Architect's Consultant from the mutual waiver of rights outlined in paragraph 11.3.7. The waiver of rights is given in exchange for property insurance covering the work.

11.2.2 Change the second sentence to include after sub-subcontractors: "…and Architects and Engineers of Record".

ARTICLE 13 – MISCELLANEOUS PROVISIONS

13.2 SUCCESSORS AND ASSIGNS

13.2.1 DELETE the last two sentences of this Subparagraph.
ADD the following as the last two sentences of the Subparagraph:

"Contractor shall not assign the Contract or any portion thereof without the written consent of Owner. Owner is entitled to assign the Contract or any portion thereof".

13.2.2 DELETE this Subparagraph in its entirety.

13.4 TESTS AND INSPECTIONS

13.4.7 ADD the following new Subparagraph:

Neither the observations of the Architect, its administration of the Contract Documents, nor inspections tests or approvals by persons other than the Contractor shall relieve the Contractor from its obligation to perform the Work in accordance with the Contract Documents.

13.6 ADD the following new Paragraph:

The Owner will require the Contractor to conduct a background check for criminal history for all workers on the project in compliance with Indiana Code 20-5-2-7 and 20-5-2-8.

"The Contractor shall provide, if awarded the right to provide services or materials under this agreement, a list of all personnel used by or on behalf of the Contractor, whether employed by them or not, who will be engaged in the providing of services or delivery of materials and goods.

With said list of persons shall be provided written evidence of a criminal record search with respect to all persons on the list dated within thirty (30) days of the said date of the Contract and extending at least twenty (20) years prior.

Contractor agrees that no person will be providing services who has any criminal conviction for any type of behavior that would place the students or staff at risk.

If evidence of such behavior occurs after this initial search, but during their employment on site, such worker shall be removed immediately from the site and shall be banned from the jobsite for the duration of the project.

Evidence of behavior that is prohibited would include, but not limited to, the following:

(1) Murder [IC 34-42-1-1].
(2) Causing suicide [IC 35-42-1-2].
(3) Assisting suicide [IC 35-42-1-2.5].
(4) Voluntary manslaughter [IC 35-42-1-3].
(5) Reckless homicide [IC 35-42-1-5].
(6) Battery [IC 35-42-2-1] unless ten (10) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole, whichever is later.
(7) Aggravated battery [IC 35-42-2-1.5].
(8) Kidnapping [IC 35-42-3-2].
(9) Criminal confinement [IC 35-42-3-3].
(10) A sex offense under ([C 35-42-4].
(11) Carjacking [IC 35-42-5-2].
(12) Arson [IC 35-43-1-1] unless ten (10) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole, whichever is later.
(13) Incest [IC 35-46-1-3].
(14) Neglect of a dependent [IC 35-46-1-4(a)(1) and IC 35-46-1-4(a)(2)] unless ten (10) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole, whichever is later.
(15) Child selling [IC 35-46-1-4(b)].
(16) Contributing to the delinquency of a minor [IC 35-46-1-8] unless ten (10) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole, whichever is later.
(17) An offense involving a weapon under IC 35-47 unless ten (10) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole,

whichever is later.

(18) An offense relating to controlling substances under IC 35-48-4 unless ten (10) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole, whichever is later.

(19) An offense relating to material or a performance that is harmful to minors or obscene under IC 35-49-3 unless ten (10) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole, whichever is later.

(20) An offense relating to operating a motor vehicle while intoxicated under IC 9-30-5 unless five (5) years have elapsed from the date the individual was discharged from probation, imprisonment, or parole, whichever is later.

(21) An offense that is substantial equivalent to any of the offenses listed in this subsection in which the judgment of conviction was entered under the law of any other jurisdiction. Should the Contractor change personnel during the existence of the Contract providing for services, it shall at least ten (10) days prior to using any other personnel other than those previously disclosed, provide the same information for the new personnel as provided for under the terms of the provision."

13.7 ADD the following new Paragraph:

The Owner will require the Contractor to conduct testing for drugs and alcohol for all workers on the project. Drugs and alcohol shall be as defined by Indiana Code 35-48-4-4.

"The Contractor shall provide, if awarded the right to provide services or materials under this agreement, a list of all personnel used by or on behalf of the Contractor, whether employed by them or not, who will be engaged in the providing of services or delivery of materials and goods.

With said list of persons shall be provided written evidence of drug and alcohol testing with respect to all persons on the list dated within seven (7) days of the said date of the Contract.

Contractor agrees that no person will be providing services who has tested positive to any of the items included and shall be banned from the jobsite for the duration of the project.

Continued testing shall be conducted throughout the project duration every six months maximum. Any persons testing positive shall be removed immediately from the site and shall be banned from the jobsite for the duration of the project.

The Contractors and their employees shall meet all State and Federal statutory requirements".

13.8 ADD the following new Paragraph:

The Contractor and all its subcontractors are required to comply with all provisions of Indiana Code 22-5-1.7 to affirm that it does not knowingly employ or contract with an unauthorized alien or retain an employee or contract with a person that they subsequently learn is an unauthorized alien.

The Contractor is required to enroll in and verify the work eligibility status of all newly hired employees of the contractor through the E-Verify program as defined in IC 22-5-1.7-3.

The Contractor is not required to verify the work eligibility status of all newly hired employees of the contractor through the E-Verify program if the E-Verify program no longer exists and the Contractor signs an affidavit affirming that the Contractor does not knowingly employ an

unauthorized alien.

13.9 ADD the following new Paragraph:

There shall be no firearms allowed on the project site or anywhere within the project property.

Exceptions would be made for law enforcement officials, security forces required elsewhere by these Specifications, or per other requirements or allowances specifically made by the Owner.

13.10 ADD the following new Paragraph:

There shall be no smoking or tobacco use allowed within the buildings, on the project site or anywhere within the project property. Violators shall be removed from the project immediately.

Any construction materials in contact with or exposure to such tobacco products shall be removed and replaced with new, at the Contractor's expense.

Additional requirements and levels of protection are afforded to Public Buildings in compliance with Indiana Code 16-41-37, and include an enclosed structure or part of an enclosed structure that is one of the following:

(1) Occupied by an agency of state or local government.
(2) Used as a classroom building or a dining area at a state educational institution (as defined in IC 20-12-0.5-1).
(3) Used as a public school (as defined in IC 20-18-2-15).
(4) Licensed as a health facility under IC 16-21 or IC 16-28.
(5) Used as a station for paid firefighters.
(6) Used as a station for paid police officers.
(7) Licensed as a childcare center or child care home or registered as a child care ministry under IC 12-17.2.
(8) Licensed as a hospital under IC 16-21 or a county hospital subject to IC 16-22.
(9) Used as a provider's office.
(10) School bus (as defined in IC 16-41-37-2.3).

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT

14.1 TERMINATION BY THE CONTRACTOR

DELETE Subparagraph 14.1.1 in its entirety and replace with the following:

14.1.1 If the Work is stopped for a period of sixty (60) days under an order of any court or other public authority having jurisdiction, or as a result of any act of government such as a declaration of a national emergency making material unavailable, through no act or failure to act of the Contractor or a Subcontractor or their agents or employees or any other persons performing any of the Work under a contract with the Contractor, and the Owner has not otherwise suspended, delayed, disrupted or interrupted the Work in accordance with the Subparagraph, then the Contractor may, upon fourteen (14) days' written notice to the Owner, terminate the Contract, and recover from the Owner payment for all Work executed to date. Recovery by the Contractor of lost anticipated profit and overhead and other consequential and incidental damages is hereby specifically excluded.

14.1.3 DELETE all words following the words "payment for" and ADD the following after "payment for":

"all work executed to date. Recovery by the Contractor of last anticipated profit and overhead and other consequential and incidental damages is hereby excluded."

ADD the following new Subparagraph 14.1.5:

14.1.5 "The Owner shall not be liable to the Contractor for the Owner's failure to perform its obligations set forth herein if such performance is prevented or interrupted by war (including the consequences thereof), fire, tornado, hurricane, windstorms, labor problems, fuel or transportation shortages, civil unrest, governmental action, or any other natural or economic disaster or cause which is reasonably beyond the control of the Owner ("Force Majeure"). If the estimated duration of the Force Majeure is one year or more, the Contractor shall have the option to terminate this Contract upon thirty (30) days' written notice. In the event that the estimated duration of the Force Majeure is less than one year, the Contract Time shall be increased by the same length of time as the Force Majeure persisted.".

14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

14.3.1 DELETE this Subparagraph in its entirety.

14.3.2 DELETE this Subparagraph in its entirety.

14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

DELETE Subparagraph 14.4.3 in its entirety and substitute the following:

14.4.3 In case of such termination for the Owner’s convenience, the Owner shall pay the Contractor for Work properly executed; reimbursable costs actually incurred, including costs attributed to termination of Subcontracts; and an amount representing six percent (6%) of the amount of the work not executed".

ARTICLE 16 - EQUAL OPPORTUNITY

16 ADD this new Article 16, including Paragraphs and Subparagraphs as follows:

16.1 POLICIES OF EMPLOYMENT

16.1.1 The Contractor and the Subcontractor shall not discriminate against any employee or applicant for employment because of race, religion, color, age, sex or national origin, in connection with, but not limited to employment, upgrading, demotion, transfer, recruitment or recruitment advertising, layoff or termination, rates or pay or other forms of compensation and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth its policies of non-discrimination consistent with this Article.

END OF SECTION 00 73 01

SECTION 00 73 16 – INSURANCE REQUIREMENTS

1.01 PROJECT MANUAL

All requirements of the Project Manual shall apply to this Section.

1.02 MINIMUM INSURANCE COVERAGES

A. Workmen's Compensation - statutory.
   1. Employer's Liability - $100,000.

B. Comprehensive General Liability (including Premises - Operations, Independent Contractor's Protective, Products and Completed Operations, Broad Form Property Damage):
   a. Bodily Injury:
      $1,000,000 - one person aggregate per project endorsement. CG2503 to be included
      $2,000,000 - annual aggregate.
   b. Property Damage:
      $1,000,000 - each occurrence.
      $2,000,000 - annual aggregate.
   c. Property Damage Liability Insurance shall include coverage for the following hazards: X (Explosion, C (Collapse), U (Underground).
   d. Wavier of subrogation to be included
   e. Additional insured form CG2010 to be included

C. Contractual Liability (Hold Harmless Coverage).
   a. Bodily Injury:
      $2,000,000 each occurrence
   b. Property Damage:
      $1,000,000 each occurrence
      $2,000,000 aggregate

D. Personal Injury, with employment exclusion deleted:
   $1,000,000.

E. Comprehensive Automobile Liability (Owned, Non-Owned, Hired):
   a. Bodily Injury:
      $1,000,000 each person.
      $1,000,000 each accident
   b. Property Damage:
      $500,000 each occurrence.
   c. Owner to be named as additional insured and provided a Waiver of Subrogation.

F. Catastrophic Umbrella Coverage, including products - complete operations:
   $2,000,000

G. Prime Contractors and all subcontractor's insurance shall be primary and non-contributory on all insurance.

END OF SECTION 00 73 16

SECTION 01 11 00 - SUMMARY OF WORK – SINGLE CONTRACT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Work covered by the Contract Documents.
2. Contractor's use of premises.
3. Coordination of work and trades.
4. Owner occupancy during construction.
5. Partial occupancy of completed work.
6. Exiting during construction.
7. Construction scheduling and phasing.

B. Project is being bid with construction work under one General Contract for all trades.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

A. Provide and pay for all materials, labor, services, equipment, licenses, permits, fees, taxes, and other items necessary for the execution, installation and completion of Work indicated in Contract Documents.

B. The Work includes coordination with Architect, Owner's Representative, Owner's separate contractors, material suppliers and vendors.

1.03 CONTRACTOR'S USE OF PREMISES

A. Contractor shall limit his use of premises for work and storage, to allow for Owner's occupancy as identified in this Section.

B. Assume full responsibility for protection and safekeeping of products stored on premises.
1. Move any stored products that interfere with operations of Owner or other Contractor.
2. Obtain and pay for use of additional storage or work areas needed for operations.
3. Available space for construction field offices and storage sheds is limited to the project site. Contractor must arrange for off site storage as required.

C. Contractor shall allow for any other work outside of this contract, whether by Owner's personnel or Contractors under Owner's separate contracts, to proceed without delay or impediment.

1.04 COORDINATION

A. Schedule, manage and expedite all work under his Contract, coordinating his work with his sub-contractors, material suppliers, vendors, and trades so that no conflicts of timing or location occur.
1. Work shall progress according to approved progress schedule.
Schedule dates for incorporation of work, and identify all critical path events and dates.
2. Coordinate and provide all floor, ceiling, roof, and wall sleeves.
3. Provide all cutting, fitting or patching required.

B. Keep Architect informed on the progress of the work.
1. Close or cover no work until duly inspected and approved.
2. Uncover un-inspected work and after approval, repair and/or replace all work at no cost to Owner.
3. Notify Architect at least 7 days in advance of utility connections, utility shut-offs, mechanical equipment and oil line cutovers, street or alley closings to allow ample time to receive Owner's written approval of procedure to be followed.
4. Coordinate all operations with the Architect and Owner. Complete in the minimum amount of time.

C. Protection:
1. Do not close or obstruct streets, entrance drives, sidewalks or other facilities without permission of the Owner and local authorities.
2. Conduct operations with minimum interference.
3. Furnish, erect and maintain barricades, warning lights, signs and guards as may be required.

1.05 OWNER OCCUPANCY

A. Owner will occupy the school building and site during entire period of construction for the conduct of their daily activities and operations.

B. Owner will vacate most areas to be renovated to facilitate the work. Work is required to be phased; scheduling shall be coordinated with the Owner in advance. Owner will move all loose furniture and fixtures to temporary locations. Fixed furniture, shelving, equipment, and fixtures will remain.

C. Cooperate with Owner or his representative in all construction operations to minimize conflict and to facilitate Owner's usage of building.

D. Conduct construction operations to assure least inconvenience to Owner and public.

E. Provide temporary heating and ventilation, temporary dust partitions, plastic sheeting, plywood sheeting, and any other means required to protect all elements of existing building from damage or deterioration during construction.

1.06 PARTIAL OCCUPANCY

A. Prior to occupancy, execute Certificate of Substantial Completion for designated area.

B. Contractor provide: Access for Owner's personnel.

C. Owner provides, upon occupancy:
1. Maintenance
2. Operation of HVAC, electrical systems.
3. Security.

1.07 EXITING DURING CONSTRUCTION

A. The Contractor shall maintain all existing building exits while the building is occupied throughout the duration of the project. Coordination is required between the Contractor and the Owner throughout construction.

B. Contractor shall participate in the Owner's fire drills and shall cease all construction activities and operations during such drills and during any fire alarm conditions that may occur.

C. Contractor shall coordinate with Fire Marshal and Building Inspector as required to meet any concerns or issues encountered throughout the duration of the project.

1.08 CONSTRUCTION SCHEDULING AND PHASING

A. Owner intends to award the Contract and issue a Notice to Proceed within 30 days after bid opening.

B. Contractor shall mobilize on site and begin work immediately thereafter.

C. The following Phasing Outlines contain a list of dates and critical scopes of work to be completed in each phase. It is not intended to be a comprehensive work list, but is shared to communicate

priorities:

1. **Phase 1A: Summer Work (May-July 2024):**
   - Owner will vacate Classroom A1 by May 3rd to allow demolition work to begin.
   - Utility relocation for kitchen addition is permitted to start on May 28th and shall be completed by July 31st.
   - Owner will vacate the cafeteria for the summer by May 31st.
   - Owner will vacate the kitchen for the duration of the project by June 7th.
   - Demolish elevated platform and perform other heavy demolition work in the cafeteria.
   - Perform heavy demolition work in the kitchen.
   - Perform heavy demolition work in Classroom A1 to prep for renovation into new main office.
   - Main building entrance and existing main office shall be accessible to the public starting August 1st.
   - Cafeteria must be occupiable for serving lunch to students starting August 7th. Owner intends to prepare food off site at another facility.

D. **Phase 1B: New Main Office & Kitchen (August 2024 - TBD):**
   1. Begin construction of kitchen addition.
   2. Renovation of existing kitchen is ongoing.
   3. Renovate Classroom A1 into new main office.
   4. Continue renovation work in cafeteria. Work shall be scheduled so as not to affect the Owner's ability to serve lunch to students.
   5. Owner will move into new main office upon Substantial Completion and vacate existing office area for renovation.

E. **Phase 2: Clinic/Office Renovation & Kitchen (Starts upon completion of Phase 1B - TBD):**
   1. Complete kitchen addition.
   2. Complete kitchen renovation.
   3. Complete clinic/office renovation.
   4. Complete renovation work in cafeteria. Work shall be scheduled so as not to affect the Owner's ability to serve lunch to students.

F. **Contractor must achieve Substantial Completion by date provided on Proposal Form.**

G. **Contractor must achieve Final Completion within (30) thirty days following Substantial Completion.**

END OF SECTION 01 11 00

NORTH HARRISON COMMUNITY SCHOOL CORPORATION
2023-24 SCHOOL CALENDAR

Semester 1

Aug-23

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Sep-23

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Oct-23

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Nov-23

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

Dec-23

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Teacher Inservice Day
No School
End of Grading Period
1st Student of Semester
Snow Make Up Day
Early Student Release Day

		Aug-23	
	1		Teacher Work Day/Open Houses
	2		Teacher Orientation Day
	3		Semester 1 - First day for students
		Sep-23	
	4		Labor Day [no school]
21			
		Oct-23	
	5		End of 1st Grading Period [45 student days]
	6-13		Fall Break [no school]
		Nov-23	
20	7		Election Day/No Students/Parent-Teacher Day
	22-24		Thanksgiving Break [no school]
		Dec-23	
4	20		End of 2nd Grading Period [44 student days]
	21-29		Christmas Break [No School]
45			
		Jan-24	
12	1-3		Christmas Break [No School]
	4		Semester 2 - First day for students
	15		ML King Day [No School/Snow Make Up]
		Feb-24	
	19		President's Day [No School/Snow Make Up]
18		**Mar-24**	
	8		End of 3rd Grading Period [45 student days]
	22-29		Spring Break [No School]
		Apr-24	
	8		Snow Make-up Day/E Learning Day
		May-24	
14	7		Election Day/No Students/E Learning Day
44	22		End of 4th Grading Period {46 Student Days}
	23		Teacher Work Day (No students)
	TBA		High School Graduation
89			

Semester 2

Jan-24

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Feb-24

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29		

Mar-24

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Apr-24

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

May-24

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

19		
20		
6		
45		
9		
21		
16		
46		
91		

Early Release Days: One hour early release every Friday for Professional Development

ILEARN / ECA Assessment Windows 2023-24*		
Year	Name of Assessment	Assessment Window
2023-2024	ILEARN Biology ECA Winter Administration	2/5/2024-2/23/2024
	ILEARN 3-8	4/15/2024-5/10/2024
	ILEARN Bilogy ECA and Opt US Govt ECA Spring	4/15/2024-5/17/2024
	SAT Primary Administration	3/4/2024-3/15/2024
	SAT Makeup Administration	4/8/2024-4-19-2024
	PSAT/NMSQT Administration Day	10/09/24-10/27/2024
	IREAD-3 Spring Administration	3/4/2024-3/15/2024
	IREAD-3 Summer Administration	5/13/2024-6/28/2024
	I AM	4/1/2024-5/10/2024
	WIDA ACCESS Annual Assessments	1/16/2024-3/1/2024

NORTH HARRISON COMMUNITY SCHOOL CORPORATION
2024-25 SCHOOL CALENDAR

Semester 1

Aug-24

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Sep-24

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

Oct-24

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Nov-24

30	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

Dec-24

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

		Aug-24	
	5		Teacher Work Day/Open Houses
	6		Teacher Orientation Day
	7		Semester 1 - First day for students
		Sep-24	
	2		Labor Day [no school]
	27		No Students-Parent Teacher Conf.
18			
		Oct-24	
	4		End of 1st Grading Period [41 student days]
	7-11		Fall Break [no school]
		Nov-24	
19	5		Election Day-No Students-Teacher Prof. Dev. Day
	27-29		Thanksgiving Break [no school]
		Dec-24	
4	20		End of 2nd Grading Period [46 student days]
	23-31		Christmas Break [No School]
41			
		Jan-25	
14	1-3		Christmas Break [No School]
	6		Semester 2 - First day for students
	20		ML King Day [No School/Snow Make Up]
		Feb-25	
	17		President's Day [No School/Snow Make Up]
		Mar-25	
17			
	7		End of 3rd Grading Period [43 student days]
	24-28		Spring Break [No School]
		May-23	
	23		End of 4th Grading Period [50 student days]
	23		High School Graduation
15	27		Teacher Work Day (No students)
46			
87			

Semester 2

Jan-25

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Feb-25

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	

Mar-25

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Apr-25

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

May-25

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

19	
19	
43	
11	
22	
17	
50	
93	

Teacher Inservice Day
No School
End of Grading Period
1st Student of Semester
Snow Make Up Day
Early Student Release Day

Early Release Days: One hour early release every Friday for Professional Development

ILEARN / ECA Assessment Windows 2023-24*		
Year	Name of Assessment	Assessment Window
2024-2025		

SECTION 01 14 00 - GENERAL CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Special Provisions.
2. Commencement Activity.
3. Quality Control.
4. Pre-final and Final/Occupancy Inspections
5. Project Closeout.

1.02 SPECIAL PROVISIONS

A. Project:
The Project is the total construction for which the Contractor is responsible, including all labor, materials and equipment used or incorporated in such construction.

B. Work:
The Work comprises the completed construction designed under the Project and includes labor necessary to produce such construction, and materials and equipment to be incorporated in such construction.

C. Contract Documents includes the following (See General Conditions 1.1.1 for definition):
1. Project Manual. (See General Conditions 1.1.7 for definition) The Project Manual is composed of the following:
   a. The Bidding Requirements.
   b. The Contract Forms.
   c. The Conditions of the Contract.
   d. The Specifications. (See General Conditions 1.1.6 for definition)
2. Drawings (See General Conditions 1.1.5 for definition)
3. Addenda (See Instructions to Bidders 1.3 for definition)
4. Other Documents as identified in the Contract for Construction, the General Conditions of the Contract for Construction, and Supplementary General Conditions

D. Demolition:
All existing Improvements on the site indicated on the Drawings to be demolished, shall be removed by Contractor. Use such methods as required to complete the work in compliance with all governing authorities and utility company requirements. All existing utility connections shall be disconnected, properly capped and removed by the Contractor. Complete removal of existing foundation walls or footings is required under new construction or other new foundations. Remove all below-grade wood and metal. Any existing basements, cisterns and/or other below grade voids shall be filled with compatible fill material suitable for proposed constructions and compacted per specific requirements. Completely remove cisterns located under new construction. All debris, rubbish, salvage and other materials shall be removed from the site. Protect all adjacent properties and structures, and existing buildings from damage.

E. Utilities:
It is the Contractor's responsibility to coordinate with the appropriate utility companies actual location of mains serving the site and route the building utility lines in the most direct route.
1. The location of utilities existing in the building as indicated on the Drawings may be modified by the Contractor to accommodate a more direct route to the utility connection location with written approval from Architect.

F. Permits and Fees:
The Contractor is responsible for verifying any and all fees required from all utilities, agencies and authorities having jurisdiction. The Contractor shall obtain and pay for the Building Permit and all other permits and governmental fees, licenses and inspections required, whether specifically referenced or not. The Contractor is to include in the bid the cost of all charges payable to State, local or special community development agencies and any additional fees as required for the completion of the project, including, but not limited to:
1. Water company connection fees and charges
2. Electrical company charges.
3. Telephone company charges.
4. Sanitary sewer connection fees and charges.
5. Gas Company charges.
6. Fire sprinkler connection fees and charges.

G. Historical and Archeological Finds: All items having any apparent historical or archeological interest discovered in the course of construction must be carefully preserved. The Contractor must leave the archeological find undisturbed and immediately report it to the Architect. Work on the project may be stopped until such find is analyzed, inspected and removed by the Governing Authority.

1.03 COMMENCEMENT ACTIVITY

A. Evidence that the Contractor has started procurement of materials, preparation and submission of shop drawings, preparation of subcontracts and other preparatory work must satisfy the requirement that work began upon receipt of Notice to Proceed.

1.04 QUALITY CONTROL

A. Testing:
1. Employ the services of an independent testing laboratory to take samples, perform tests and make inspections. The costs for such laboratory and tests shall be borne by the Contractor.
2. Submit testing reports as per Architect.
3. Refer to Section 01 45 00-Quality Control for additional requirements.

1.05 PRE-FINAL AND FINAL/OCCUPANCY INSPECTIONS

A. The Contractor is to notify in writing, the Architect, that the work is complete for a Pre-Final Inspection (also referred to as “Final Punchlist Inspection”. The Contractor must provide the Architect at least 10 calendar days advance notice.

B. The Contractor is to diligently complete all punchlist items before a Final/Occupancy Inspection is scheduled.

1.06 PROJECT CLOSEOUT

A. Cleaning during construction:
1. The premises and the job site shall be maintained in a reasonable neat and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and other flammable waste materials or trash from the work areas at the end of each working day. Do not allow debris to blow onto adjoining properties. Respond immediately to request from adjoining property owners to remove any debris that does manage to show up on adjoining properties.
2. Maintain the project in clean condition until the Owner accepts the building.
3. Refer to Section 01 74 23 - Cleaning for additional requirements.

B. Closeout Procedures:

Refer to Section 01 77 00 - Closeout Procedures for additional requirements.

C. Closeout Submittals:
   1. Before the project can be closed out, the Contractor shall have provided all submittals required by the Contract Documents. All submittals required by the Contract Drawings or Specifications shall be sent to the Architect for review and coordination, in accordance with the requirements of the respective Drawing or Specification section. Any items that the Architect determines are incomplete or incorrect shall be corrected and resubmitted.
   2. Refer to Section 01 78 00 - Closeout Submittals for additional requirements.
   3. Refer to Section 01 78 46 - Closeout Maintenance Materials for additional requirements.

D. Retainage:
   1. The Architect will assign a monetary value to all punchlist items not completed, and to all required submittals not received, as of the date of "Final Acceptance" and an amount equal to 200 percent of the total value of those items shall be retained and/or deducted from the Contractor's final payment until the Contractor demonstrates to the Architect's satisfaction that such items have been completed or corrected. Refer to the General Conditions and Supplementary General Conditions for additional information regarding retainage.

END OF SECTION 01 14 00

SECTION 01 21 16 - CONTINGENCY ALLOWANCE

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Contingency Allowance in Contract Sum.

1.02 CONTINGENCY ALLOWANCE

A. Allow a lump sum fee of *$ 325,000.00*.

B. To be included in the Base Bid of Contract.

C. Itemize Contingency Allowance on Application and Certificate for Payment and Schedule of Values.

D. Contingency Allowance to be used for unforeseen conditions encountered during the work.

E. Do not include any contractor's additional costs in bid.
Adjustments to contingency allowance will include labor, material, transportation, overhead and profit.
All costs for these items to be included in all proposals to Architect for adjustments to contract.

F. Use Funds in Contingency Allowance only on written agreement between Owner, Architect and Contractor.

G. All Proposals shall be authorized by the Architect prior to execution and recorded in Contractor's as-builts and Architect's project Record Documents.

H. Adjustment to Allowances will be made by Change Order.
Any unused amounts to be credited back to the Owner.

END OF SECTION 01 21 16

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Procedures for exercising alternates.
2. Identification and description of alternates.

B. All items, either indicated on the Drawings or specified in the Project Manual, not specifically indicated to be included in a specific alternate is to be included within the base bid scope of work.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Bidding Requirements: Quotation of cost for each alternate as listed on Proposal Form.

B. Owner-Contractor Agreement: Alternates accepted by Owner for incorporation into the work.

C. Sections of Specifications identified by work of each alternate.

1.03 PROCEDURES

A. Alternates will be exercised at the option of Owner.

B. Coordinate related work and modify surrounding work as required to complete the Work, including changes under each Alternate, when acceptance as designated in Owner-Contractor Agreement.

C. All Alternates shall be bid.
Base Bid to be all work as shown on the Drawings and Specifications, except Alternates.

D. Owner reserves the right to accept or reject any and all Alternates as determined solely at the discretion of the Owner. Alternates may be accepted or rejected independently from one another, and in any order of priority or hierarchy as determined by the Owner.

1.04 SCHEDULE OF ALTERNATES

A. **ALTERNATE NO. 1: ACOUSTICAL WALL PANELS**
1. Give the amount to be **ADDED** to the Base Bid for the following:
   a. Provide and install wall mounted acoustical panels in Cafeteria 133 as shown on Drawings I301 and I302 and as specified in Section 09 84 00.

2. Base Bid to include:
   a. No acoustical wall panels.

B. **ALTERNATE NO. 2: INTERCOM SYSTEM MODIFICATIONS**
1. Give the amount to be **ADDED** to the Base Bid for the following:
   a. Provide and install new speakers and wiring in areas of work as shown on Power/Systems Drawings.
   b. Provide new wiring and relocate Owner's handheld console unit to new main office as indicated on Drawing E4.0C
   c. All new wiring to have additional length for extension to main office IDF closet for connection to analog to IP conversion in the future.
   d. Intercom demolition scope indicated on plans shall be included in all bid options.

2. Base Bid to include:
   a. Rough-in boxes, raceways, and supports for intercom devices and wiring to be installed by Owner's separate contractor.
   b. Intercom demolition scope indicated on plans shall be included in all bid options.

END OF SECTION 01 23 00

SECTION 01 29 73 - SCHEDULE OF VALUES

1.01 REQUIREMENTS INCLUDES

A. Section Includes:
   1. General Requirements.
   2. Format and Content.

1.02 GENERAL REQUIREMENTS

A. Submit to the Architect/Engineer a Schedule of Values allocated to the various portions of the Work.

B. Upon request of the Architect/Engineer, support the values with data which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Architect/Engineer, shall be used as the basis for the Contractor's Application and Certificate for Payment.

1.03 FORMAT AND CONTENT

A. Type schedule on AIA Document G703, Continuation Sheet for Application and Certificate for Payment. Identify schedule with:
   1. Title of Project as listed on cover of Project Manual
   2. Architect project number.
   3. Name and Address of Contractor.
   4. Contract Designation.
   5. Date of submission.

B. Schedule shall list the installed value of the component parts of the Work in sufficient detail, as determined by the Architect, to serve as a basis for computing values for progress payments during construction.
   1. Follow the table of contents of this Project manual as the format for listing component items.
   2. Identify each line item with the number and title of the respective major section of the specifications.
   3. Identify separate line items for all items for materials and labor.
   4. Identify further breakdown for any and all items as determined by the Architect.

C. For Mechanical and Electrical Scope of Work, major products or operations are to be listed.

D. For the various portions of the work:
   1. Each item shall include a directly proportional amount of the contractor overhead and profit.
   2. For items on which progress payments will be requested for stored materials, break down the value into:
      a. The cost of the materials, delivered and unloaded, with taxes paid.
      b. The total installed value.

E. The sum of all values listed in the schedule shall equal the total Contract Sum.

END OF SECTION 01 29 73

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Administrative and supervisory personnel.
2. Submittals.
3. Contractor quality control.
4. Coordination Drawings.
5. Project coordination.

B. Procedures for preparation, updating and submittal of Construction Progress Documentation.

1.02 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Project Coordination Administrator: Contractor Representative experienced in administration, supervision, and quality control of building expansion and alteration construction, similar to Work of this Project, including mechanical and electrical work.

B. Project Field Superintendent:
1. Contractor Representative experienced in general field supervision of building construction, similar to Work of this Project, including mechanical and electrical work, to supervise, direct, inspect and coordinate Work of Contractor, subcontractors, suppliers and installers, and expedite Work to assure compliance with Construction Schedules.
2. Superintendent must read, write, and speak English fluently.
3. Superintendent must be present at the Project site whenever work is being performed. Superintendent must remain on the Project from Notice to Proceed to Substantial Completion. Do not change personnel without written permission from the Owner.

1.03 SUBMITTALS

A. Submit list of Contractor's principal staff assignments, including Project Coordination Administrator, Project Field Superintendent, Quality Control Representative, and other personnel in attendance at site; identify their duties and responsibilities.

B. Submit all items for execution of Contract as listed in Section 00 43 93 – Contractor’s Bid Submittal checklist.

C. Submit shop drawings, product data, and other required submittals, in accordance with Section 01 33 00 - Submittal Procedures, for review and compliance with Contract Documents, for field dimensions and clearances, for relation to available space, and for relation to Work by Owner or separate Contracts.

D. Submit Requests for Information and interpretation of Contract Documents in a timely manner and obtain replies from Architect in accordance with the Contract.

1.04 CONTRACTOR QUALITY CONTROL

A. Perform project quality control in accordance with requirements in the Contract.

B. Coordinate scheduling of inspection and testing required by individual specification Sections and in accordance with Section 01 45 00 - Quality Control.

1.05 COORDINATION DRAWINGS

A. Prepare and distribute coordination drawings where close coordination is required for installation of Products and materials fabricated off-site by separate entities, and where limited space availability requires maximum utilization of space for efficient installation of different components. Show interrelationship of components shown on separate shop drawings. Indicate required installation sequences.

1.06 PROJECT COORDINATION

A. Coordinate construction activities and work of all trades under various Sections of these Specifications and Work of Contract to facilitate orderly installation of each part of Work. Coordinate construction operations included under different Sections of Specifications and Contract that are dependent upon each other for proper installation, connection, and operation.

B. Where installation of one part of Work is dependent on installation of other components, either before or after that part of Work, schedule construction activities in sequence required to obtain uninterrupted installation.

C. Obtain drawings, manufacturer's product data, instructions, and other data to provide a complete and proper installation.
   1. Check field dimensions prior to installing products.
      Verify necessary clearances and means of access from equipment storage to final position.
   2. Make data and information available to trades involved.

D. Ensure that utility requirements of operating equipment are compatible with building utilities. Coordinate Work of various specification Sections for installation and final connection of equipment.
   1. Assure that mechanical, plumbing, and electrical rough-ins have been properly located.

E. Coordinate space requirements and installation of mechanical, plumbing, and electrical Work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, conduits, and wiring, as closely as possible; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. Where availability of space is limited, coordinate installation of different components to ensure maximum accessibility for required maintenance, service, and repair.

G. Provide for installation of items scheduled for future installation.

H. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Prepare memoranda for Architect and separate contractors where coordination of their work is required.

I. In finished areas, conceal pipes, ducts, conduits, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.

J. Coordinate completion and clean up of Work of separate Sections in preparation for completion of work per the Contract.

K. After Owner occupancy of Project, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize to Owner.

END OF SECTION 01 31 00

SECTION 01 31 19 - PROJECT MEETINGS

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Contractor participation in pre-bid conference, pre-construction conferences, progress meetings, and pre-installation meetings.
   2. Architect shall schedule and chair Project Meetings and prepare summary minutes for distribution by Contractor to all in attendance.

1.02 PRE-BID CONFERENCE

A. Architect will administer pre-bid conference to provide further understanding of Scope of Work.

B. Attendance:
   1. Architect.
   2. All prospective bidding Contractors, Subcontractors, Suppliers and Vendors.
   3. Attendance is not required, but strongly encouraged.

C. Agenda:
   1. Review Notice-to-Bidders.
   2. Review Bid Requirements and Contractor's Bid Submittal Checklist.
   3. Review Summary of Work.
   4. Review Construction Document set.
   5. Review Project Site (if necessary).
   6. Questions and Answers.

D. Architect will notify all bidders as to time and place of Pre-Bid Conference.

1.03 PRE-CONSTRUCTION CONFERENCES

A. Architect will administer pre-construction conference.

B. Attendance:
   1. Architect.
   2. Owner's Representative.
   3. Contractor's Project Manager.
   4. Contractor's Job Superintendent.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Exchange of preliminary submittals.
   3. Submission of executed bonds and insurance certificates.
   4. Distribution of Contract Documents.
   5. Submission of Schedule of Values. (If not required before hand).
   6. Designation of personnel representing the parties in Contract.
   7. Procedures and processing of Requests for Information, field decisions, submittals, substitutions, Applications for Payment, proposal requests, Change Orders, and contract closeout procedures.
   8. Scheduling.
   9. Construction facilities and temporary controls.
   10. Notice to Proceed.

D. Architect will record minutes and distribute copies to Contractor and Owner and those affected by

decisions made. Contractor is responsible for distribution of copies to Subcontractors, Suppliers and Vendors.

E. Architect will administer mobilization conference at Project site for clarification of Contractor responsibilities in use of site and for review of administrative procedures.

1.04 PROGRESS MEETINGS

A. Architect shall schedule and administer Project Meetings throughout progress of the Work not less frequently than every month. Additional Project Meetings shall be scheduled as appropriate to construction activity.

B. Attendance:
1. Architect.
2. Owner's Representative.
3. Contractor's Project Manager.
4. Contractor's Job Superintendent.
5. Major Subcontractors and Suppliers.
6. Contractor's Quality Control Representative.
7. Others as appropriate to agenda topics.

C. Agenda:
1. Review of and corrections to minutes of previous meetings.
2. Review of Work progress and/or payment progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Status of pending changes and substitutions.
14. Other business relating to Work.
15. Review of Construction Progress Documentation.

D. Architect will record minutes and distribute copies to Owner and Contractor. Contractor shall distribute copies to all others.

E. Contractor shall hold separate meetings with workers, sub-contractors and suppliers to coordinate means and methods of construction, and jobsite safety. Do not use Owner/Architect Progress Meetings for such purpose.

1.05 PRE-INSTALLATION MEETINGS

A. When required in individual specification sections or as determined necessary by Architect, convene a pre-installation meeting at work site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect seven days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of installation, preparation and installation procedures.
   2. Review coordination with related work.
   3. Agenda items listed in individual specification Sections.
   4. Installation schedule.

E. Architect will record minutes and distribute copies to participants, and those affected by decisions made.

END OF SECTION 01 31 19

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Construction Progress Schedule.
2. Contractor as-built drawings.
3. Provisions for format, content, revisions, submittals and distribution.

1.02 CONSTRUCTION PROGRESS SCHEDULE

A. Format:
1. Prepare Schedules as horizontal bar chart with separate bar for each major portion of Work or operation, identifying first work day of each week.
2. Sequence of Listings: The Table of Contents of this Project Manual.
3. Form: Contractor's option.

B. Content:
1. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
2. Identify each item by major Specification section number.
3. Provide sub-schedules to define critical portions of entire Schedule.
4. Show accumulated percentage of completion of each item, and total percentage of Work completed, to correspond with Application for Payment. Percentage of completion shall not include stored materials.
5. Provide separate schedule of submittal dates for shop drawings, product data, and samples and dates reviewed submittals will be required from Architect. Show dates for selection of finishes.
6. Show delivery dates for Owner furnished items, if any.
7. Coordinate content with Section 01 29 73 - Schedule of Values.

C. Revisions:
1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
2. Identify activities modified since previous submittal, major changes in scope and other identifiable changes.
3. Provide narrative report to define problem areas, anticipated delays and impact on Schedule. Report corrective action taken or proposed and its effect.

D. Submittals:
1. Submit initial Schedules immediately following Award of Contract.
After review, revise data and immediately submit for re-review.
2. Submit up-dated Progress Schedules with each Application and Certificate for Payment.
3. An updated Progress Schedule is required for review/consideration for Application and Certificate for Payment.
4. Submit under transmittal letter.

E. Distribution:
1. Distribute copies of reviewed schedules to Architect job site file, subcontractors, suppliers and other concerned entities including separate contractors.
2. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in Schedules.

1.03 CONTRACTOR AS-BUILT DRAWINGS

A. Format:
1. Contractor's job superintendent to record as-built conditions onto a single set of project drawings for all trades included in scope of work.
2. As-built set to be kept on site at all times.
3. Documentation may be hand written in ink or pasted directly onto drawings. All information must be considered to be permanently affixed.

B. Content:
1. Include work of all trades included in scope of work.
2. Include all changes, errors, deviations, omissions, additions, clarifications and corrections.
3. Include any item installed in a location other than that shown on contract drawings.
4. Correct any inaccurate or altered dimension.

C. Revisions:
1. As-built drawings shall be updated daily with all work completed.
2. Contractor job superintendent to be responsible for subcontractor information on as-built drawings.

D. Submittals:
1. As-built drawings may be reviewed at progress meetings or periodically as requested by Architect to review entries to date.

E. Distribution:
1. As built drawings shall be given to Architect prior to release of final payment.
2. Refer to Section 01 78 00 - Closeout Submittals.

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Submittal Schedule.
2. Submittal Requirements.
3. Shop Drawings.
4. Electronic files provided by the Architect.
5. Product Data.
6. Samples.
7. Manufacturer's Information.
8. Review by Contractor and Architect.
9. Re-submittals.
10. Distribution.

1.02 SUBMITTAL SCHEDULE

A. Submit to the Architect a schedule listing all submittals required for review as required in the individual specifications sections.

B. List submittals by specification section as listed in the index.

1.03 SUBMITTAL REQUIREMENTS

A. Formats:
1. Submit all drawings and technical data electronically in PDF format.
2. Furnish all submittals specified in all sections of the specifications.
3. Submit each section under a separate transmittal for clarity and ease of review.
4. Make a complete submittal for each section; do not issue multiple submittals per section.
5. Compile all sheets, drawings, and product data into a single electronic file for review.
6. Do not submit multiple PDF files per sheet or item.
7. Identify manufacturer and subcontractor/supplier.
8. Submit Material and Safety Data Sheets for all products and materials.
9. Name each PDF file to match specifications title and number, matching that as listed in the project manual.
10. Submit to Architect via Architect's project management website specific to this project.
11. Submit actual samples for finishes, colors, and textures for approval via mail or hand delivery.

B. Transmit submittals in accordance with approved Progress Schedule and in such sequence to avoid delay in the Work or work of other contracts.

C. Apply Contractor's stamp, signed or initialed, certifying to review, verification of products, field dimensions and field construction criteria and coordination of information with requirements of Work and Contract Documents.

D. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
1. Finishes which involve Architect selections of colors, textures, or patterns.
2. Associated items which require correlation for efficient function or for installation.

1.04 SHOP DRAWINGS

A. Present in a clear thorough manner, drawn by professional draftsman.

B. Identify project with title as shown on cover of Project Manual; identify each element of drawings by reference to sheet number and detail, schedule, or room number on Contract Documents.
C. Identify field dimensions; show relation to adjacent or critical features of Work or products.

D. Sheet Size:
   1. Minimum: 8-1/2 x 11 inches.
   2. Maximum: 30 x 42 inches.

1.05 ELECTRONIC FILES PROVIDED BY THE ARCHITECT

A. Architect may make available, at no cost, base xref drawings in AutoCAD format for contractor's use in preparing shop drawings.

B. AutoCAD version of electronic files will be the latest version being utilized in the Architect's office. The Architect has no obligation to provide electronic files in a format that may be an old, outdated, reduced or simplified version of that being utilized in the Architect's office.

C. Electronic files are an instrument of the Architect's service, and are the property of the Architect.

D. The use of the information contained in the electronic files is at the sole risk of the user.

E. The use of the electronic files does not relinquish the contractor from responsibilities for site and field verification of spaces, construction, conditions, requirements, dimensions, etc.

1.06 PRODUCT DATA

A. Submit only pages which are pertinent; mark each copy of standard printed data to identify pertinent products, referenced to Specification Section and Article number. Show reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances.

B. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the Work. Delete information not applicable.

C. Provide manufacturer’s published catalog pages and industry cutsheets, with all items and options marked as appropriate to the project.

1.07 SAMPLES

A. When finishes are specified on the Drawings, submit samples of the specified finish for approval.

B. When finishes are not specified on the Drawings, submit full range of manufacturer’s standard finishes, except when more restrictive requirements or price groups are specified, indicating colors, textures, and patterns, for Architect’s selection.

C. Submit samples to illustrate functional characteristics of products, including parts and attachments.

D. Label each sample with identification required for transmittal letter.

E. Submit number of samples specified in individual specifications sections but not less than three (3).

F. Special circumstances may require additional samples for determination of acceptance, such as textures, patterns, colorways, etc. Provide sample in the quantity and/or size as required for this determination.

Requirements to be determined solely by the Architect.
All such samples will be returned to the Contractor, less those retained for Owner and Architect files.

G. Samples for selection of finishes need to be submitted as actual samples of the actual colors, materials and textures for proper selection and review of available choices. Samples for finishes already selected as indicated in the Drawings may be color charts in lieu of actual samples, if acceptable to the Architect.
H. All samples may be retained for Owner and Architect files.

I. See individual Specification sections for additional information and requirements.

1.08 MANUFACTURER'S INFORMATION

A. Manufacturer's instructions for storage, protection, preparation, assembly, installation, adjusting, balancing and finishing.

B. Installation details, anchoring requirements or other information specifically required by manufacturer.

C. Specific information or details required by Manufacturer to uphold warranty of product specified.

1.09 CONTRACTOR'S REVIEW

A. Review submittals prior to transmittal; verify subcontractor's field measurements, field construction criteria, manufacturer's catalog numbers, and conformance of submittal with requirements of Contract Documents.

B. Coordinate submittals with requirements of Work and of Contract Documents.

C. Affix a stamp and sign each drawing, manufacturer's data, sample, etc. as follows:

This submittal has been reviewed by (*Name of Contractor*) and approved with respect to the means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incidental thereto. (*Name of Contractor*) also warrants that this submittal complies with contract documents and comprises no variations or increase in contract price thereto. By:-_____ Date:_____

D. Notify Architect in writing at time of submittal, of any deviations from requirements of Contract Documents. Architect will neither accept incomplete submittals, nor those which in the Architect's opinion, have not been properly reviewed by the Contractor.

E. Do not fabricate products or begin work which requires submittals until return of submittal with Architect acceptance.

F. Submittals which have not been thoroughly reviewed by Contractor prior to being forwarded to Architect will be rejected and returned for review.

1.10 ARCHITECT'S REVIEW

A. Architect will review shop drawings, product data, and samples and return submittals within a reasonable time frame for complete review and approval.

B. Architect's review is for conformance with information given and design concept expressed in the Contract Documents. The review shall not constitute approval of safety precautions, or of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

C. Review of shop drawings does not authorize changes to the contract sum unless stated in a separate letter or change order.

1.11 RE-SUBMITTALS

A. Make re-submittals under procedures specified for initial submittals; identify changes made since previous submittals.

1.12 DISTRIBUTION

A. Duplicate and distribute reproductions of shop drawings, copies of product data, and samples, which bear Architect's stamp of approval, to job site file, Contractor's Record Documents file, sub-contractors, suppliers and other entities requiring information.

END OF SECTION 01 33 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Specification format and content.
2. Quality assurance.
3. Reference standards.
4. Abbreviations.

1.02 SPECIFICATION FORMAT AND CONTENT

A. Specification Format:
Specifications are organized into Divisions and Sections based on Construction Specifications Institute (CSI) Division format and Master Format numbering system.

B. Specification Content:
This Specification uses certain conventions in use of language and intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
1. Abbreviated Language:
Language used in Specifications and other Contract Documents is abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and context of Contract Documents so indicates.
2. Imperative and streamlined language is used generally in Specifications. Requirements expressed in imperative mood are to be performed by Contractor. At certain locations in text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by Contractor, or by others when so noted.
3. The words "shall be" shall be included by inference wherever a colon (:) is used within a sentence or phrase.

1.03 QUALITY ASSURANCE

A. For Products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes. Such standards are made a part of Contract Documents by reference.

B. Conform to reference standard by date of issue current on original date of issue indicated on Contract Documents.

C. Obtain copies of standards when required by Contract Documents.

D. Maintain copy at Project Site during submittals, planning, and progress of specific Work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from the Architect before proceeding.

F. The contractual relationship, duties, and responsibilities of the parties in Contract nor those of Architect shall not be altered from Contract Documents by mention or inference otherwise in any reference document.

1.04 REFERENCE STANDARDS

A. Conflicting Requirements:
Where compliance with two or more standards is specified, and the standards may establish different or conflicting requirements for minimum quantities or quality levels. Refer requirements that are different, but apparently equal, and uncertainties to Architect for decision before proceeding.

1. Minimum Quantity or Quality Levels:
Quantity or quality level shown or specified shall be the minimum provided or performed. Actual installation may comply exactly with minimum quantity or quality specified, or it may exceed minimum within reasonable limits. In complying with these requirements, indicated numeric values are minimum or maximum, as appropriate for context of requirements.
Refer uncertainties to Architect for decision before proceeding.

B. Copies of Standards:
Each entity engaged in construction on Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with Contract Documents.

1. Where copies of standards are needed for performance of a required construction activity, Contractor shall obtain copies directly from publication source.

1.05 ABBREVIATIONS

A. Abbreviations and Names:
Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in Specifications or other Contract Documents, they mean the recognized name of trade association, standards generating organization, authority having jurisdiction, or other entity applicable to context of text provision. Refer to "Encyclopedia of Associations," published by Gale Research Company, available in most libraries.

END OF SECTION 01 42 00

SECTION 01 45 00 - QUALITY CONTROL

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. General Requirements.
2. Qualifications.
3. Laboratory Requirements.
4. Building Survey.
5. Quality Control Procedures.
6. Testing and Inspection Laboratory Services.
7. Contractor Field Inspection and Testing.
8. Contractor’s Daily Report.
9. Contractor’s Test and Inspection Reports.
10. Non-Compliance Check-Off List.
11. Completion and Inspection of Work.

1.02 GENERAL REQUIREMENTS

A. Survey:
1. Engage licensed surveyor, without extra cost to the Owner.
2. Assure correct position of building on site, establish correct levels, lines and grades, verify column centers, walls, trenches, establish grades and bench marks at all grading and drainage improvements, and otherwise fully and completely layout work required by this Contract.

B. Inspection, Sampling, and Testing is required for:
1. Soils Compaction Control
2. Cast-In-Place Concrete
3. Mortar, Grout and CMU Units
4. Anchor Bolt Torque
5. Structural Steel Connections
6. Metal Roof Deck Fastening
7. Mechanical testing
8. Electrical testing

C. Employment of Testing Laboratory or Inspector shall in no way relieve Contractor of his obligation to perform Work in accordance with Contract and Contract Documents.

1.03 QUALIFICATIONS

A. Testing laboratory's qualifications:
1. Testing laboratory should be pre-qualified prior to bidding.
2. Testing laboratory must have a registered professional engineer as full time staff.
3. Testing laboratories wishing to be included on the pre-qualified list herein shall submit qualifications in writing to the Architect no later than ten (10) days prior to the bid.

B. Pre-qualified testing laboratories:
1. ECS Southeast, LLP
1762 Watterson Trail; Louisville, KY 40299
502-493-7100; 502-493-8190 fax
2. Hagerty Engineering, Inc.
335 Spring Street B; Jeffersonville, IN 47130
502-553-3211

3. Asher Engineering, Inc.
   1021 South Floyd Street; Louisville, KY 40203
   502-589-0073; 502-589-0076 fax
4. ATC Group Services / Cardno ATC
   11001 Bluegrass Parkway, Suite 250; Louisville, KY 40299
   502-710-0264; 502-267-4072 fax

1.04 LABORATORY REQUIREMENTS

A. Meet basic requirements of ASTM E 329 for inspection and testing agencies for concrete and steel as used in construction.

B. Perform specified inspections, sampling and testing of materials and methods of construction:
   1. Comply with specified standards; ASTM, other recognized authorities, and as specified.
   2. Ascertain compliance with requirements of Contract Documents.

C. Promptly notify Architect/Engineer and Contractor of irregularities or deficiencies of Work which are observed during performance of services.

D. Promptly submit one (1) electronic copy of all reports, inspections and tests to Architect, to include the following:
   1. Date, project title and number.
   2. Testing Laboratory name and address.
   3. Name and signature of inspector.
   4. Dates of inspection, sampling, and test.
   5. Record of temperature and weather.
   6. Identification of product and specification section.
   7. Location in project.
   8. Type of inspection or test.
   9. Observations regarding compliance with Contract Documents.

1.05 BUILDING SURVEY

A. Horizontal Control Survey:
   1. After earthwork is completed and before any foundation excavation commences, Contractor shall run and maintain a closed, offset traverse outside the building perimeter a suitable distance with 2" x 2" hub stakes driven flush and bearing a Surveyor's tack at all intervening building grids.
      a. Each hub shall be flagged, protected, and identified by a clearly visible guard stake.
      b. Appropriate temperature, and sag corrections must be applied if traverse is measured by Surveyor's chain.
   2. If transit visibility between opposing hubs straddling the building is impossible, additional lines of hubs tacked, flagged, protected, and identified as above) shall be installed along lines through the building and tied into the perimeter traverse.
   3. The completed traverse (if not run by) shall be checked, drawn up and certified by a Licensed Surveyor employed by the Contractor and approved by the Architect.
      a. An experience record and professional references shall be submitted along with a request for the approval of any Surveyor.
      b. One copy of the certified drawing shall be posted in the Contractor's field office for reference.
      c. Additional copies of the drawing shall be posted in the Contractor's field office for reference.
      d. Until such time as all foundation; reinforced concrete piers and columns; and steel column anchor bolts are in place, all stakes will be maintained.
      e. The services of the approved Surveyor shall be secured by the Contractor to re-establish all hubs damaged or lost for any reason.
   4. All foundations; concrete column dowels and forms; and steel column anchor bolts shall be

located by transits set up only over traverse hub stakes.
a. Anchor bolts shall be secured in final position by fixing into wood templates, or other approved methods before any concrete is cast.
b. The Architect reserves the right to reject the equipment or the personnel.

B. Vertical Control:
1. After earthwork is completed, the Contractor shall establish building bench marks of 2" Ø i.d. Galvanized Pipe driven a minimum of 4'-0" into ground and having tops level with finished ground floor.
a. Sufficient bench marks shall be installed for each ground floor level so that no level shot will exceed 200 feet.
b. Level circuits will begin at and close to bench marks referenced on the site plans.
2. The approved Licensed Surveyor shall include in his certification that he has checked (or set) all herein required bench marks.

1.06 QUALITY CONTROL PROCEDURES

A. Monitor quality control over Contractor staff, subcontractors, suppliers, manufacturer's, products, services, site conditions, and workmanship.

B. Comply fully with manufacturer's published instructions, including each step in sequence of installation.

C. Should manufacturer's published instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for Work, except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons who are thoroughly qualified and trained in their respective trade, to produce workmanship of specified quality.

F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

G. Perform tests required by governing authorities having jurisdiction and utilities having jurisdiction.

1.07 TESTING AND INSPECTION LABORATORY SERVICES

A. Selection and Payment:
1. Employment and payment for services of an Independent Testing and Inspection Laboratory to perform specified testing and inspection, by Contractor.

2. Employment of Independent Testing and Inspection Laboratory in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents

B. Quality Assurance:
1. Comply with requirements of ASTM C 802, ASTM C 1077, ASTM C 1093, ASTM D 290, ASTM D 3740, ASTM D 4561, ASTM E 329, ASTM E 543, ASTM E 548, and ASTM E 699.
2. Laboratory: Authorized to operate in State in which Project is located.
3. Laboratory Staff: Maintain a full time registered engineer on staff to review services.
4. Testing Equipment: Calibrated at reasonable intervals with devices of and accuracy traceable to either National Bureau of Standards or accepted values of natural physical constraints.

C. Laboratory Responsibilities:

1. Contractor should ensure the Laboratory has the following responsibilities and limits on authority (See D).
2. Test samples of mixes submitted by Contractor.
3. Provide qualified personnel at Project site. Cooperate with Architect and Contractor in performance of services.
4. Perform specified sampling, testing, and inspection of Products in accordance with specified standards.
5. Determine compliance of materials and mixes with requirements of Contract Documents.
6. Promptly notify Contractor Quality Control Representative and Architect of observed irregularities or non-conformance of Work or Products.
7. Perform additional tests as required by Architect.
8. Attend appropriate preconstruction meetings and progress meetings.

D. Limits on Authority:
1. Laboratory may not release, revoke, alter, or expand on requirements of Contract Documents.
2. Laboratory may not approve or accept any portion of Work.
3. Laboratory may not assume any duties of Contractors.
4. Laboratory has no authority to stop Work.

1.08 CONTRACTOR FIELD INSPECTION AND TESTING

A. Contractor:
Test and Inspect Work provided under this Contract to ensure Work is in compliance with Contract requirements. Required tests and inspections are indicated in each individual Specification Section.

B. Preparatory Inspection:
Performed prior to beginning Work and prior to beginning each segment of Work and includes:
1. Review of Contract requirements.
2. Review of shop drawings and other submittal data after return and approval.
3. Examination to assure materials and equipment conform to Contract requirements.
4. Examination to assure required preliminary or preparatory Work is complete.

C. Initial Inspection:
Performed when representative portion of each segment of Work is completed and includes:
1. Performance of required tests.
2. Quality of workmanship.
3. Review for omissions or dimensional errors.
4. Examination of products used, connections and supports.
5. Approval or rejection of inspected segment of Work.

D. Follow-Up Inspections:
Performed daily, and more frequently as necessary, to assure non-complying Work has been corrected.

E. Testing and Inspection:
Perform testing and inspection in accordance with requirements in individual Sections.

1.09 CONTRACTOR'S DAILY REPORT

A. Submit daily report to Architect, for days that work was performed. Include the following information:
1. Contractor name and address.
2. Job reference and information.
3. Date, weather, minimum and maximum temperatures, rainfall, and other pertinent weather occurrences.
4. Daily workforce of Contractor and subcontractors, by trades.

5. Description of work started, ongoing work, and work completed by each subcontractor.
6. Coordination implemented between various trades.
7. Approval of substrates received from various trades.
8. Nonconforming and unsatisfactory items to be corrected.
9. Remarks.
10. Reports may be faxes to Architect no more than one week's worth of reports at one time. Submit daily if requested by Architect.

1.10 CONTRACTOR'S TEST AND INSPECTION REPORTS

A. Prepare and submit, to Architect, a written report of each test or inspection signed by Contractor Quality Control Representative performing inspection within two (2) days following day inspection was made.

B. Include the following on written reports of inspection:
   1. Cover sheet prominently identifying that inspection "CONFORMS" or "DOES NOT CONFORM" to Contract Documents.
   2. Date of inspection and date of report.
   3. Project name, location, solicitation number, and Contractor.
   4. Names and titles of individuals making inspection, if not Contractor's Project Field Superintendent.
   5. Description of Contract requirements for inspection by referencing Specification Section.
   6. Description of inspection made, interpretation of inspection results, and notification of significant conditions at time of inspection.
   7. Requirements for follow-up inspections.

1.11 NON-COMPLIANCE CHECK-OFF LIST

A. Maintain check-off list of Work that does not comply with Contract Documents, stating specifically what non-complying, date faulty Work was originally discovered, and date Work was corrected. No requirement to report deficiencies corrected same day it was discovered. Submit copy of Non-Compliance Check-Off List of non-complying work items to Architect on a weekly basis.

1.12 COMPLETION AND INSPECTION OF WORK

A. Prior to final acceptance by Architect, submit a certification signed by Contractor to Architect stating that all Work has been inspected and all Work, except as specifically noted, is complete and in compliance with Contract Documents.

B. Record Documents:
   1. By Contractor Quality Control Representative. Ensure that "As-Builts" required are marked to show any deviations which have been made during the course of construction and are kept current on a daily basis. Upon completion of the Work, certify the accuracy of the "As-Builts" and submit to Architect.
   2. Refer to Section 01 32 00 - Construction Progress Documentation.
   3. Refer to Section 01 78 00 - Closeout Submittals.

END OF SECTION 01 45 00

SECTION 01 51 00 - TEMPORARY UTILITIES

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Responsibility of Owner and Contractor.
2. Provisions for temporary electrical power.
3. Provisions for temporary lighting.
4. Provisions for temporary heating and ventilation
5. Provisions for temporary water.
6. Provisions for temporary telephone and internet.
7. Regulatory Agency Requirements.

1.02 RESPONSIBILITY

A. Responsibility of Owner:
1. Owner is not responsible for the establishment or payment of any temporary utilities.
2. Pay all utility bills from the utility companies for Owner's existing established utility services within existing buildings and construction limits for the duration of construction.
3. Owner is not responsible for any costs directly to the contractor for non-established utility items including such items as fuels, tanks, generators, extensions, hookups, feeds, cords, hoses, wiring, etc. as may be required by the contractor for their ability to provide needed temporary utilities specified herein.
4. Owner is not responsible for any Contractor job overhead costs such as cell phones, internet, water hauling, etc. that may be required as part of the construction activities.

B. Responsibility of Contractor:
1. Pay all utility bills for all new or temporary utility services within construction limits for duration of construction.
2. Coordinate establishment, timing and all requirements of all temporary utilities with all utility companies and authorities having jurisdiction.
3. Coordinate establishment, timing and all requirements of all permanent utilities, including new services and/or reworking of existing services, with all utility companies and authorities having jurisdiction.
4. Provide, install, re-install, remove, coordinate, etc, any and all temporary utilities to all areas of the site and project resulting from any and all phasing of the work.
5. Provide temporary electrical power, as required.
6. Provide temporary lighting, as required.
7. Provide temporary heating and ventilation, as required.
8. Provide temporary water, as required.
9. Provide temporary telephone and internet, as required.
10. Coordinate shut-offs of any and all utilities with Owner at least 24 hours in advance.
11. Each individual Contractor to provide temporary utilities for all contractors, crews and trades under their control or within the scope of work for their contract.

1.03 DESCRIPTION

A. Temporary Electrical Power:
1. Contractor may need to provide portable electric generators until utility service is available.
2. Provide adequate electrical power centers, wiring and services for all tools, equipment and miscellaneous items.
3. Locate so that power is available at any point with no more than 100 foot extension.
4 If required, provide minimum 200 ampere volt service entrance for voltage required.

5. Provide weather-proof distribution boxes at power centers, minimum four 20-amp 120 volt grounded outlets, with ground fault circuit breaker protection. Additional circuits as required.
6. Provide equipment grounding continuity for entire system.
7. Individual contractors and users provide grounded UL approved extension cords from power center.
8. Contractor to provide power for any and all temporary field offices, architect's field office, storage and construction buildings.
9. Contractor to provide power for temporary lighting, heating, ventilation and air conditioning.
10. Contractor to provide power for pumping, welding and other special equipment or procedures.
11. Provide temporary covers or plates for any and all openings, electrical boxes, receptacles, etc. that may be open during construction or awaiting installation of final covers or plates.

B. Temporary Lighting:
1. Provide work lighting, safety lighting and security lighting.
2. Provide lighting for construction and storage areas.
3. Provide lighting for Owner's tours or access to site areas for review.
4. Lightings Levels:
   a. General work lighting and safety lighting 5 foot candles.
   b. Finishing and detail work 20 foot candles.
5. Periods of Service:
   a. Work and safety lighting continuous during working hours.
   b. Security lighting at all hours of darkness.
6. Replace lamps throughout, as required.
7. Provide temporary exit signs as required for phasing of work or relocation of exits and egress paths.

C. Temporary Heating and Ventilation:
1. Provide as required to protect work and products against dampness and cold.
2. Provide suitable ambient temperatures for installation and curing of materials.
3. Provide adequate ventilation for safe working environment in accord with health regulations.
4. Heat and ventilate temporary field offices and other storage and construction buildings.
5. Temperatures Required:
   a. Minimum 40°F, 24 hours a day.
   b. During working hours and 24 hours a day during concrete and masonry work: 50°F.
   c. During interior finish work, 24 hours a day, 7 days prior to placing finishes until substantial completion: 70°F.
6. Ventilation required to prevent hazardous accumulation and harmful exposure of dusts, fumes, mists, vapors or gases.
7. Ventilation required for curing installed materials, humidity dispersal and sanitary facilities.
8. Gas for temporary heating shall be from portable tanks only, not the use of natural gas system.
9. Building system may be used for temporary heat only with approval of Architect. Areas must be sufficiently cleaned so as not to cause damage to system from construction dust and dirt.
10. New filters are to be installed prior to operation of system.
11. Contractor to replace all filters with new in all temporary and permanently installed units during construction every two (2) weeks minimum, and more frequently during times and in areas of heavy demolition work. Maintain and install additional cloth filters over all return air outlets at all times.
12. New filters must be replaced just prior to owner occupancy.

D. Temporary Water:
1. Provide service standpipe, centrally located, with minimum of two (2) 3/4" hose bibbs.
2. Discharge pressure: Minimum 20 psi.
3. Individual contractors and users provide hoses from hose bibbs.
4. Maintain adequate water volume for all purposes.
5. Provide water for temporary sanitary facilities, field offices, storage buildings, and cleaning and

construction operations.
6. Obtain required certification from authorities.
7. If offsite water is required, Contractor shall pay all costs of water and hauling.
8. Provide temporary caps, valves, shut-offs, and spigots as required.
9. Contractor is to coordinate supply of water to areas of building which are to remain in service.
10. Running of hoses through portions of an existing building is not allowed without approval of Owner.

E. Temporary Telephone and Internet:
1. Provide, maintain and pay for telephone service to Contractor's field offices throughout construction.
2. Contractor’s job site superintendent is required to have a cellular/mobile phone at all times during normal working hours.
3. Use of cellular/mobile phones are allowed for temporary phone service.
4. Use of Owner’s lines is prohibited; phone, fax, or internet.
5. If contractor desires internet or e-mail service for their use at the jobsite, the contractor shall be responsible to provide it, and shall bear all costs for its installation and use. Use of any Owner's wireless internet service is prohibited, without express permission.

1.04 REGULATORY AGENCY REQUIREMENTS

A. Obtain and pay for permits as required by authorities.

B. Obtain and pay for temporary easements as required across property other than Owners.

C. Comply with applicable Federal, State, and Local Codes:
1. Occupational Safety and Health Act of 1970, as amended.
2. National Electric Code.
3. National Electric Safety Code.

D. Comply with Utility Regulations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials may be new or used, adequate in capacity for the purpose intended, without creating unsafe conditions or violating codes.

B. Comply with Electrical Basic Materials and Methods, Division 26:
1. Temporary wiring shall include green equipment grounding conductor and all outlets shall be grounding type.
2. Provide required facilities, including transformers, conductors, poles, conduits, raceways, breakers, fuses and switches.
3. Provide vapor proof and explosion proof fixtures in applicable areas.

C. Comply with Basic Mechanical Requirements, Division 23:
1. Provide required facilities, including piping, valves, pumps, pressure regulators and tanks.
2. Portable Heaters: Oil or gas fired with electric blower, not requiring vent from heated space.
3. Salamanders shall not be used.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with applicable sections of Division 23, Mechanical and Division 26, Electrical.

B. Install work in neat and orderly manner, structurally sound.

C. Locate services to avoid interference with traffic, work and storage areas, material handling equipment and cranes.

D. Modify service as work progress requires.

3.02 INSTALLATION

A. Electrical:
1. Service and distribution may be overhead or underground.
2. Locate lighting to provide full illumination of required areas.
3. Locate controls at entrance to each area.
4. Install security lighting throughout all areas.
5. Wire temporary heating equipment.
6. Do not run branch circuits on floor.

B. Heating and Ventilation:
1. Locate to provide equitable distribution as required.

C. Water:
1. Do not run piping on floor or ground.
2. Locate water outlets to provide service convenient to work.
3. Provide drip pan under hose bibbs within the building, connect to drain.
4. Provide insulation to prevent pipes from freezing.
5. Provide temporary pumps, tanks and compressors as necessary to maintain pressure.

3.03 REMOVAL

A. Remove completely all temporary materials and equipment upon completion of construction or when no longer required.

B. Clean and repair damage caused by temporary installation and restore to satisfactory condition per Owner and Architect.

C. Immediately prior to completion of project, remove temporary lamps and install new lamps throughout.

END OF SECTION 01 51 00

SECTION 01 53 00 - TEMPORARY CONSTRUCTION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Temporary Structures:
a. Contractor's Field Offices.
b. Storage Trailers.
c. Enclosures.
d. Toilets.
e. Stairs, Ladders, Ramps, etc.
f. Temporary Fence.
g. Project Signage.
2. Installation.
3. Removal and Cleanup.
4. Protection.

PART 2 - PRODUCTS

2.01 TEMPORARY STRUCTURES

A. Contractor's Field Offices:
1. Provided by General Contractor.
2. The Contractor's offices required for general use and project meetings.
3. Type Option: Portable typical trailer units.
4. Windows, operable, screened; provide view of construction.
5. Automatic heating to maintain min 70°F.
6. Furnish emergency first-aid equipment, ABC fire extinguisher, extra hard hats.
7. Furnishings: Provide desk, chairs, adequate drawings reference board, drawing racks, and filing cabinets as needed.
8. Security: Provide window and door locks so that each office can be made independently secure.
9. Thermometer: Install a new bulb type weather thermometer on outside of office, adjacent to window for inside reading. Do not install in direct sunlight.

B. Storage Trailers:
1. Provided by General Contractor or subcontractor as required.
2. Coordinate location with Architect.
3. Remove at project completion and clean up area.

C. Enclosures:
1. Provided by General Contractor.
2. Provide temporary weather-tight enclosures for all exterior openings.
3. Equip exterior doors with locks and closures.

D. Toilets:
1. Provided by General Contractor.
2. Provide temporary sanitary facilities during construction period.
3. Enclose toilet facilities for construction personnel.
4. Portable units acceptable. No chemical toilets permitted.
5. Do not use toilets in existing or new building.

E. Stairs, Ladders, Ramps, etc.:
1. Provided by General Contractor.
2. Provide temporary stairs, ladders, ramps runways, scaffolds, derricks, chutes and similar items

required for proper execution of work by the trades.

F. Temporary Fence:
1. Provided by General Contractor.
2. Chain link fence, 6'-0" high, minimum.
3. Provide fencing located as necessary to enclose the entire project construction limits, prior to work beginning. Provide with gates of sufficient size and quantity.
Coordinate all locations and requirements with Architect and Owner's Representative.
4. Routing of fencing shall include all areas the Owner deems necessary to ensure the safety of the inhabitants of the site and the general public, as determined by construction operations on site.
5. Provide separate entrance gates for union and non-union personnel.
Gates shall be clearly identified. Locate gates at opposite ends of the project site.

G. Project Signage:
1. Provided by General Contractor.
2. Provide project identification sign of wood frame and exterior grade medium density overlay plywood construction, painted with lettering by professional sign painter, per Architect's design and colors.
List title of project, Owner, Architect and Contractor. See drawings for detail, if applicable.
3. Signage of individual contractors or sub-contractors will be allowed only for identification of temporary offices and off site storage areas.
4. No other signage or advertisement will be allowed on the project site.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Temporary Structures:
1. Locate as directed to avoid interference with work.
2. Relocate as required and as directed by Architect.
3. Construct with code-approved service connections.
4. Mount fire extinguishers in prominent accessible location.
5. Maintain offices during construction period.
6. Provide wooden steps and landing with handrail.
7. Provide crushed stone walkway.

B. Temporary Enclosures:
1. Erect temporary doors as soon as enclosing walls are up.
2. Cover window or wall openings in advance of finishing operations when temporary heat is required.
3. Replace with permanent closures as soon as possible.
4. Install temporary partitions as required to control dust and moisture penetration into existing and completed spaces.
5. Provide temporary protection for installed products.
6. Provide temporary enclosures and fencing protection as indicated on temporary exiting plans.
Locate, relocate, and coordinate as required to accommodate phasing of work, progress of work, code and fire officials, and concerns of Owner and Architect.

C. Temporary Toilets:
1. Locate as directed in convenient location to avoid interference with project.
2. Anchor portable units to prevent dislocation.
3. Service daily.
4. Relocate as work progresses.

D. Temporary Construction Apparatus:
   1. Erect Scaffolding, securely in conformance with labor laws and safety codes.
   2. Construct stairs, ladders, ramps, runways and derricks security to sustain 100 psf minimum live load or as required for their use.

3.02 REMOVAL AND CLEAN UP

A. Remove all temporary structures and materials completely upon completion of construction.

B. Remove debris and clean area.

C. Repair all damage and restore to finish condition.

3.03 PROTECTION

A. Safety:
   1. Maintain lights and barricades on all obstruction and hazards during contract period in conformance to federal and local laws and codes.

B. Fire Protection:
   1. Provide multi-purpose dry chemical extinguishers.
   2. Locate one extinguisher adjacent to each stairway.
   3. Wherever and whenever any burning, welding, cutting or soldering operations are in progress, or equipment is in use, or any work involving a fire hazard is performed, the Contractor or Subcontractor responsible for such operation shall have at all times acceptable fire extinguishers or protection within ten feet of the operation.

C. Piping:
   1. Keep materials out of piping by capping or other protection.
   2. Trades responsible for stoppage shall bear expense of cleaning.

D. Equipment:
   1. Each contractor and subcontractor shall take necessary precautions to protect and secure own equipment, tools and material.

E. Surface Water Control:
   1. Grade site to drain properly at all times, without accumulation of water.
   2. Maintain excavations free of water. Pump excavation as required.
   3. Protect site from erosion. Do not allow erosion to leave site.

END OF SECTION 01 53 00

SECTION 01 62 00 - PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

Section Includes:

1. Contractor's options.
2. Requests for substitutions.

1.02 CONTRACTOR'S OPTIONS

A. For products specified only by referenced standards, select product meeting standards and submit for approval in accordance with this section.

B. For products listing several manufacturers or model numbers, the following criteria apply:

1. For specification sections naming a list of acceptable manufacturers and only one manufacturer's specific model name or number, alternate products from the list of acceptable manufacturers are acceptable only if they are equivalent to the named, specific, model name or number in all respects. If the alternate manufacturer's product is not equivalent to the named, specific, model name or number in all respects, then that manufacturer's product is not an acceptable substitution, even though they are named as an acceptable manufacturer in the specification section. Proposed products from listed alternate manufacturers with no model name or model number listed must be submitted in accordance with this section.

2. For specification sections naming a list of acceptable manufacturers, and no specific model number from any of the listed manufacturers is named in the specification, alternate products from named manufacturers are acceptable provided that they are equivalent to the listed performance criteria and referenced standards in all respects. If the alternate manufacturer's product is not equivalent to the listed performance criteria and referenced standards in all respects, then that manufacturer's product is not an acceptable substitution, even though they are named as an acceptable manufacturer in the specification section.

3. For specification sections naming a list of acceptable manufacturers and a number of manufacturer's specific model numbers, any of the named, specific, referenced products as listed are acceptable. Alternate products from the listed acceptable manufacturers are acceptable only if they are equivalent to at least one of the named, specific, model names or numbers in all respects. If the alternate manufacturer's product is not equivalent to at least one of the named, specific, model names or numbers in all respects, then that manufacturer's product is not an acceptable substitution, even though they are named as an acceptable manufacturer in the specification section. Proposed products from listed alternate manufacturers without a listed model name or number must be submitted in accordance with this section.

C. For products specified by naming only one product and manufacturer, there is no option, and no substitution will be allowed. This item may have been specified in this manner to standardize the Owner's maintenance procedures or stock inventory, comply with the Owner's warranty requirements, or to maintain compatibility with existing construction. In some instances, this item may have been specified to determine a level of quality or performance desired and requests for substitutions may be accepted for consideration as determined by the Architect.

1.03 REQUESTS FOR SUBSTITUTIONS

A. During period of bid preparation, Architect will consider written requests for substitutions, received at least ten (10) calendar days prior to bid date; requests received after that time will not be considered.

B. Products proposed for installation by the Contractor and approved by the Architect shall not be changed except with written consent of the Architect.

C. Submit all information to the Architect electronically via e-mail or CD, unless otherwise permitted. If hard copies are permitted, submit two (2) copies of all information.

D. Include the following information in request.
Submittals or product catalogs without the following specific information listed will not be considered.
1. Complete data substantiating compliance of proposed substitution with Contract Documents.
2. Product Data:
    a. Product identification, including manufacturer's name and address.
    b. Manufacturer's literature;
        1) Product description.
        2) Performance and test data.
        3) Reference standards.
        4) Material safety and data sheets.
    c. Samples.
    d. Name and address of similar projects which may be visited in vicinity of project on which product was used and date of installation.
3. Construction Method: detailed description and drawings of proposed method.
4. Itemized comparison of proposed substitution with product or method specified.
5. Data relating to changes in construction schedule.
6. Relation to separate contracts.
7. Accurate cost data on proposed substitution in comparison with product or method specified.
8. Literature of item proposing to replace, proving equality and comparison.

E. In making the request for substitution, Bidder/Contractor represents:
1. They have investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
2. They will provide the same warranty requirements for substitution item as for product or method specified.
3. They will coordinate and accommodate installation of accepted substitution into the work, making such changes as may be required for work to be complete in all respects and trades.
4. The Bidder/Contractor waives all claims for any and all additional costs or time related to this substitution which consequently become apparent, by contractor, subcontractors, vendors, and suppliers. Bidder/Contractor shall be responsible for any and all costs, direct or indirect, resulting from this Request.
5. Cost data is complete and includes all related costs under his Contract, but excludes:
    a. Costs under separate contracts.
    b. Architect's redesign costs, if any.

F. Substitutions will not be considered if (in the opinion of the Architect):
1. Request is not received within the proper timeframe for consideration prior to the bid date.
2. Request does not contain the proper information for determination of substitution.
3. Item has been specified with no substitutions permitted.
4. Item is not considered to be equal to that specified.
5. Item would require substantial revision to the Contract Documents or design intent.
6. Item would have an adverse effect on the project or construction schedule.
7. Item would have an adverse effect on other trades or scope of work.

8. Item is deemed unacceptable by the Owner for any reason.
9. Item is deemed not equal to the desired aesthetic or have an adverse aesthetic effect; including colors, textures, patterns or appearance specified or intended.
10. They are indicated or implied on shop drawings or project data submittal without formal request submitted in accordance with this Section.
11. They have not been included in an addendum during bidding.
12. They are made after award of Contract.

G. It is the responsibility of the bidder to make a complete and proper submission for their request for substitution, to the correct party as indicated in the specifications and within the required timeframe. The Architect is not responsible for any errors in the bidders submission, including such items as sending information to the incorrect contact person, or sending the request to the incorrect mailing address, fax number or e-mail address.

H. The decision of the Architect is FINAL.

END OF SECTION 01 62 00

SECTION 01 64 00 - OWNER-FURNISHED EQUIPMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Description of work.
   2. Definitions.
   3. Protection and Cleaning.
   4. Building Systems.

1.02 DESCRIPTION OF WORK

A. Coordinate the installation of the equipment or system with all trades. Any problem noted shall be brought to the attention of the Architect. This notification must be submitted in writing and no claims for additional work shall be considered unless the request for clarification has been initiated by the Contractor.

B. Work includes installation of owner furnished items as noted on drawings and coordination of owner installed items with owner's representatives, and vendors and suppliers.

1.03 DEFINITIONS

A. OFCI: (Owner Furnished - Contractor Installed)
   1. The Owner shall be responsible for furnishing equipment or system for installation by Contractor.
   2. The Contractor shall be responsible for receiving, storing, protecting, providing all rough-in services, installing and testing of the equipment or system. The Contractor shall receive, inventory, verify quantity and condition and notify the Owner of any discrepancies or damage. The Contractor shall provide coordination, blocking, connections and all provisions necessary to fully incorporate into the project, scope, building and site.

B. CFCI: (Contractor Furnished - Contractor Installed)
   1. The Contractor shall be responsible for ordering, receiving, storing, protecting, installing and testing of the equipment or system.
   2. Unless otherwise noted, ALL work shown on drawings and specified is C.F.C.I.

C. OFOI: (Owner Furnished - Owner Installed)
   1. The Owner shall be responsible for furnishing and installing this equipment or system.
   2. The Contractor shall be required to furnish any rough-ins as shown on the Contract Documents, and cooperate with the Owner and their vendors to coordinate this work with work of the Contract.

1.04 PROTECTION & CLEANING

1. Contractor shall protect and clean all O.F.C.I. items, treating them the same as if they had been purchased by the contractor.

1.05 BUILDING SYSTEMS

A. Voice/Data Network System:
   1. Owner's Responsibility:
      a. Furnish and install system equipment complete.
      b. Provide servers, computers, routers, racks, handsets, switches, etc.
      c. Provide, install and connect all wire and cable from patch panels to system equipment.

   2. Contractor's Responsibility:
      a. Provide and install all cable tray, conduit, backboxes, junction boxes, backboards, power outlets, outlet devices and plates, patch panels, sleeves through walls and floors and other items or work

not specifically indicated.
b. Provide, install and connect all wire and cable from ultimate outlet locations to patch panels.

c. Complete final connections and testing and certification of those connections between ultimate outlet locations and patch panels.
d. See Electrical Drawings and Specifications for additional information and clarification.

B. Video Presentation and Communication System:
1. Owner's Responsibility:
a. Will determine the type of system to be used.
b. Furnish and install system equipment complete.
c. Provide, install and connect all wire and cable from ultimate outlet location to system equipment.
2. Contractor's Responsibility:
a. Provide and install all conduit, backboxes, junction boxes, power outlets, outlet devices and plates, sleeves through walls and floors and other items or work not specifically indicated.
b. Provide and install wire and cable from patch panel to ultimate outlet location.
c. Coordinate with Owner's vendor/installer.
d. See Electrical Drawings and Specifications for additional information and clarification.

C. Electronic Door Access Control System:
1. Owner's Responsibility:
a. Provide and install credential readers and make all final connections to access control system.
b. Perform all programming required for new devices.
2. Contractor's Responsibility:
a. Provide and install all equipment, door hardware and components as included in bid documents.
b. Provide and install all wire and cable and connections between various equipment, door hardware and components and between these components and access control panels as required.
c. Provide and install all conduit, backboxes, junction boxes, power outlets, outlet devices and plates, sleeves through walls and floors and other items or work not specifically indicated.
d. Coordinate exact locations of backboxes in walls and ceilings prior to rough-in.
e. Coordinate with Owner's vendor/installer.
f. See Electrical Drawings and Specifications for additional information and clarification.

D. All Other Items Indicated on Drawings as O.F.C.I.
1. Owner's Responsibility:
a. Will determine the type system to be used.
b. Deliver items to job site.
2. Contractor's Responsibility:
a. Provide coordination, blocking and install items.
b. Provide any and all connections and provisions necessary to fully incorporate into the project.

END OF SECTION 01 64 00

SECTION 01 65 00 - PRODUCT DELIVERY AND HANDLING

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Material shipments and project delivery to job site.
   2. Handling of materials and products included in project.
   3. Phasing of the work.

1.02 DELIVERY

A. Delivery materials, supplies or equipment to Project site during working hours.

B. Deliveries made during other than normal working hours must be received by an authorized agent of the Contractor.

C. No employee of the Owner is authorized to receive any shipment designated for this project.

D. The Owner assumes no responsibility for receiving any shipments designated for this project.

E. Under no circumstances may shipments be directed to, or in care of, the Owner.

1.03 HANDLING

A. All materials furnished under this Contract shall be identified, shipped, addressed, consigned, etc., to the Contractor who may be charged therewith by giving the name of the Contractor, the name of the project, the street and the city.

1.04 PHASING OF THE WORK

A. Work may be phased, limiting installation of materials to separate areas of site or times of construction.

B. Any and all coordination of materials on site related to phasing of the work shall be accomplished by the Contractor at no additional costs to the Owner.

C. All materials, equipment, and associated items and components for the scope of work are to be delivered to the site only as and when needed for installation. Time allowed on site prior to installation shall be a reasonable timeframe as deemed acceptable by the Architect.

D. All items on site shall be stored off the ground and protected by watertight encapsulating cover in preparation for immediate installation.

E. Any and all items on site in a timeframe deemed unacceptable by the Architect for any reason, or deemed to be damaged by improper handling or storage, are to be removed from the site and returned to the manufacturer, without cost to the Owner. Products shall be replaced entirely with new materials at the time needed and deemed acceptable for installation.

END OF SECTION 01 65 00

SECTION 01 73 29 - CUTTING AND PATCHING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Make several parts fit properly.
   2. Uncover work to provide for installation of ill-timed work.
   3. Remove and replace defective work.
   4. Remove and replace work not conforming with requirements of Contract Documents.
   5. Remove samples of installed work as specified for testing.
   6. Remove existing construction necessary to install new materials, equipment, mechanical or electrical items.

PART 2 - PRODUCTS

2.01 MATERIALS

For replacement of work removed: Comply with Specifications.

PART 3 - EXECUTION

3.01 PREPARATION

A. General:
   1. Do not endanger any other work by cutting or altering work or any part of it.
   2. Do not cut or alter work of another contractor without the written consent of Architect.
   3. Patching and refinishing shall be executed by the trade experienced in such finishing work.

B. Prior to cutting:
   1. Provide shoring, bracing and support as required to maintain structural integrity of project.
   2. Provide protection for other portions of project.
   3. Provide protection from elements.
   4. Advise Architect designating time work will be uncovered to provide for observation.

3.02 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs and new work.

B. Execute excavating and backfilling by methods which will prevent damage to other work and will prevent settlement.

C. Execute fitting and adjustment of products to provide a finished installation to comply with specified tolerances, finishes.

D. Cut existing concrete openings for piping, floor drains, etc., by core drilling.

E. Cut existing walls, floors, ceilings, roofs, etc. necessary for the proper installation of new materials, equipment, mechanical or electrical items. Provide all necessary framing, lintels, hangers, etc. to maintain the structural integrity of the building system after cutting.

F. Employ original installer to perform cutting and patching for exposed finished surfaces.

G. Restore work which has been cut or removed; install new products to provide completed work in accord with requirements of Contract Documents.

H. Contractor is responsible for cost to restore or patch adjacent surfaces to original condition.

I. Fit work airtight to pipes, sleeves, ducts, conduits and other penetrations.

J. Refinish entire surface as necessary to provide an even finish.
   1. Continuous surfaces: To nearest intersections.
   2. Assembly: Entire refinishing.

END OF SECTION 01 73 29

SECTION 01 74 23 - CLEANING

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Description of general cleaning requirements.
   2. Regulatory agency requirements.
   3. Cleaning during construction.
   4. Final Cleaning.

1.02 DESCRIPTION

A. The General Contractor is responsible for all cleaning unless specifically noted otherwise.

B. Maintain premises and public properties free from accumulations of waste, debris, and rubbish, caused by operations.

C. Remove temporary piping and wiring: by respective contractors.

D. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all sight-exposed surface; leave project clean and ready for occupancy.

1.03 REGULATORY AGENCY REQUIREMENTS

A. Maintain project in accord with Occupational Safety & Health Act of 1970 as amended, in terms of clean up.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish and waste materials on project site.
   2. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains, or bury below ground.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacture.

PART 3 - EXECUTION

3.01 CLEANING DURING CONSTRUCTION

A. Execute cleaning to insure that building, grounds and public properties are maintained free from accumulations of waste material and rubbish on a daily basis by all trades.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. At reasonable intervals during progress of Work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

H. Ensure that no construction materials or items are accessible to public on site or grounds.

3.02 FINAL CLEANING

A. Employ experienced workman or professional cleaners for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints and other foreign materials from sight-exposed interior and exterior finished surfaces; polish surfaces so designated to shine finish.

D. Wash and clean all glass, removing labels.

E. Clean and polish fixtures, equipment and materials.

F. Repair, patch and touch-up marred surfaces to specified finish, to match adjacent surfaces.

G. Vacuum all carpeted areas; wax and polish all tile and resilient flooring areas.

H. Remove all foreign materials from roof and site area.

I. Broom clean paved surfaces; rake clean other surfaces of grounds.

J. Each Prime Contractor shall be responsible for cleaning all equipment installed by the respective contractors.

K. Mechanical and Electrical Work:
1. Respective contractors shall perform cleaning of their equipment.
2. Mechanical contractor shall clean all strainers in his respective piping work.
3. Replace throw-away type air conditioning filters or media if units were operated during construction, or clean ducts, blowers and coils if air conditioning units were operated without filters.
4. This does not include replacing filters used for performance testing and balancing.
5. Replace burned out or inoperative pilot and lighting lamps; by contractor furnishing respective equipment or fixture.
6. Replace all bulbs in fixtures used for temporary lighting during construction.

L. Conduct final cleaning and preparation of surfaces and materials as per manufacturer's recommendation and in strict accordance with manufacturer's guidelines.

M. All materials and finishes shall be stripped, waxed, polished, buffed, etc., upon Substantial Completion for their use by Owner.

N. Owner will assume responsibility for cleaning as time designated on Certificate of Substantial Completion, Conditional Acceptance or partial occupancy, whichever is first, for Owner's acceptance of Project or portion thereof.

END OF SECTION 01 74 23

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:

1. Administrative procedures in closing out the work.
2. Procedures for Substantial Completion.
3. Procedures for Final Inspection.
4. Required contractor guarantees.
5. Evidence of payments and release of liens.
6. Final adjustment of accounts.
7. Final Application and Certificate for Payment.
8. Post construction inspection.
9. Closeout submittals required are specified in Section 01 78 00.
10. Closeout maintenance materials required are specified in Section 01 78 46.

1.02 SUBSTANTIAL COMPLETION

A. Submit written certification to Architect that project or designated portion of project is substantially complete and ready for use by Owner.

B. Architect will make an inspection within a reasonable time after receipt of such notice. The Contractor is responsible for the final punchlist inspection in accordance with the General Conditions. No inspection by the Architect will be made until the Contractor submits written certification that the punchlist has been issued and complete. The Architect's Substantial Completion inspection is not for the purpose of preparing a "to-do" list for the Contractor to use in finishing the work. If it becomes apparent at the time of the Substantial Completion inspection that items affecting life safety, accessibility, security, or full intended use of space are not complete, the inspection will be terminated and the Contractor will be liable for the costs of re-inspection.

C. Should Architect consider that work is not substantially complete:

1. Architect shall immediately notify Contractor, in writing, stating reasons.
2. Contractor to remedy deficiencies and send second written notice of substantial completion to Architect.
3. Architect will re-inspect Work.
4. Contractor to pay costs of Architect's re-inspection.

D. When Architect/Engineer considers that work is substantially complete; Architect will prepare and issue a Certificate of Substantial Completion, AIA Document G704, complete with signatures of Owner and Contractor, accompanied by Contractor's list of items to be completed or corrected ("Punchlist") as verified and amended by the Architect. Retainage amounts will be adjusted per General Conditions and Supplementary General Conditions.

1.03 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.
2. Work has been completed and inspected in accordance with Contract Documents.
3. Equipment and systems have been tested in presence of Owner's representative and are operational.
4. Work is completed, and ready for final inspection.
5. If any items from the Certificate of Substantial Completion Inspection are not completed, the final inspection will be terminated and the Contractor will be liable for the costs of re-inspection.

B. Architect will make final inspection after receipt of certification.

C. Should Architect consider that work is incomplete or defective:
1. He shall promptly notify Contractor, in writing, stating reasons.
2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Architect/Engineer certifying that Work is complete.
3. Architect will re-inspect Work.
4. Contractor to pay costs of Architect's re-inspection.
5. Final payment will not be released.

D. When Architect finds that work is acceptable in accordance with Contract Documents, he shall request contractor to prepare Project Closeout Submittals in accordance with Section 01 78 00.

1.04 GUARANTEES

A. Contractor agrees to make good all damage to the construction of building or site or equipment which in the opinion of the Architect is a result of or incidental to the use of materials, equipment or workmanship which are inferior, defective or not in accordance with the specifications.

B. In case repairs become necessary, the Owner will give written notice to the Contractor to make same and in case of failure of the Contractor to commence such repairs within 30 days after such notice, the Owner may make the repairs either by its own employees or by independent contract and may thereupon recover from the Contractor and his Sureties the cost of the repairs so made together with the cost of supervision and inspection thereof. The Owner will have sixty (60) days after the expiration of said guarantee period in which to notify the Contractor of any such repairs necessary on the date of such expiration. The determination of the necessity for repairs shall rest entirely with the Architect whose decision upon the matter shall be final and obligatory upon the Contractor.

C. The Guarantees herein stipulated shall extend to the whole body of the improvement and all its appurtenances.

1.05 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

A. Contractor to execute and submit:
1. Contractor's Affidavit of Payment of Debts and Claims (AIA Document G706).
2. Contractor's Affidavit of Release of Liens (AIA Document G706A)
3. Consent of Surety to Final Payment (AIA Document G707).

B. All submittals shall be duly executed before delivery to Architect.

1.06 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit final statement of account to Architect.

B. Statement shall reflect all adjustments:
1. Original Contract Sum.
2. Additions and deductions resulting from:
a. Change Orders.
b. Cash Allowances
c. Contingency Allowance.
d. Unit Prices
e. Deductions for uncorrected work.
f. Penalties and Bonuses.
3. Total Contract Sum, as adjusted.

4. Previous payments.
5. Sum remaining due.

C. Architect will prepare final Change Order reflecting approved adjustments to Contract Sum not previously made by Change Orders or Allowance Adjustments.

1.07 FINAL APPLICATION AND CERTIFICATE FOR PAYMENT:

A. Contractor shall submit final application in accordance with procedures and requirements of General and Supplementary Conditions prior to submission of Final Application and Certificate for Payment.

B. Architect will review Final Application and issue Final Certificate in accordance with provisions of General Conditions.

C. Should final completion be materially delayed through no fault of Contractor, Architect may issue a Semi-Final Certificate for Payment in accordance with provisions of General Conditions.

1.08 POST CONSTRUCTION INSPECTION

A. Prior to expiration of one year from date of Substantial Completion, Architect may make visual inspection of Project in company with Owner and Contractor to determine whether correction of Work is required in accordance with provisions of General Conditions.

B. For Guarantee beyond one year Architect may make inspections at request of Owner after notification to Contractor.

C. Architect will promptly notify Contractor, in writing, of any observed deficiencies.

D. Any/all corrections to work at that time to be at Contractor's expense.

END OF SECTION 01 77 00

SECTION 01 78 00 - CLOSEOUT SUBMITTALS

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Operation and Maintenance Manuals.
2. Product Warranties.
3. Project Record Documents (As-Built Drawings).
4. Spare-Parts.
5. Certificates of Inspection.
6. Food Service Equipment Maintenance Manuals.
7. Keys and Keying Schedule.
8. Instruction of Owner's Personnel.
9. Certificate of Occupancy.
10. Certification of Asbestos and Lead-Based Paint.
11. Closeout maintenance materials required.

B. Unless specifically permitted by the Architect, the Contractor is to provide all items listed herein to the Owner via the Architect prior to the date of Substantial Completion.

1.02 OPERATION AND MAINTENANCE MANUALS

A. Submission Requirements:
1. Furnish Owner with all manual information electronically in PDF format.
2. Furnish Owner with two (2) sets of bound hard copy manuals.
3. Submit to Architect for review of information and forwarding to Owner for Owner’s records.

B. Preparation:
1. Prepare data by personnel experienced in maintenance and operation of described products.
2. Obtain information directly from manufacturer of equipment or product.

C. Format:
1. Prepare organization of data in the format of an instructional manual.
2. Cover:
a. Identify manual with title OPERATION AND MAINTENANCE MANUAL.
b. Identify title of Project.
c. Identify subject matter of contents.
3. Organization:
a. Divide sections for each separate product and system, with description of product and major component parts of equipment.
b. For any hard copies required, provide tabbed dividers between each section.
4. Text:
a. Include all manufacturer's published data and product cutsheets.
b. For any hard copies required, provide on 20 pound paper.
5. Drawings:
a. Provide applicable drawing files from manufacturer or Architect’s drawing files as required. Contact Architect to obtain PDF drawing files as needed.
b. For any hard copies required, provide with reinforced punched binder tab. Bind in with text. Fold larger drawings to size of text pages.

6. Binders (for any hard copies required):

a. Commercial quality, 8-1/2 x 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size.
b. When multiple binders are used, correlate data into related consistent groupings.

D. Contents:
1. Table of Contents:
Provide title of Project; names, addresses, and telephone numbers of Architect/Engineer, Subconsultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
2. For Each Product or System:
List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
3. Product Data:
Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
4. Drawings:
Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
5. Typed Text:
As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
6. Warranties:
Include a copy of each.
7. Reports:
Include a copy of all test reports, certificates, testing and balance data, etc.

E. Manual for Materials and Finishes:
1. Building Products, Applied Materials, and Finishes:
Include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured Products.
2. Instructions for Care and Maintenance:
Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
3. Moisture Protection and Weather Exposed Products:
Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
4. Additional Requirements:
As specified in individual Product specification Sections.
5. Provide a list of all materials and finishes with scanned photo files or actual samples of all products.

F. Manual for Equipment and Systems:
1. Each Item of Equipment and Each System:
Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.
2. Panelboard Circuit Directories:
Provide electrical service characteristics, controls, and communications; typed.
3. Operating Procedures:
Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

4. Maintenance Requirements:
   Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
5. Include color coded wiring diagrams as installed.
6. Provide servicing and lubrication schedule, and list of lubricants required.
7. Include manufacturer's published operation and maintenance instructions.
8. Include sequence of operation by controls manufacturer.
9. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
10. Provide control diagrams by controls manufacturer as installed.
11. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
12. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
13. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
14. Include test and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing.
15. Additional Requirements as specified in individual Product specification Sections.
16. Provide a list of design data, settings, setpoints, etc., as applicable for equipment.

1.03 PRODUCT WARRANTIES

A. Submission Requirements:
   1. Furnish Owner with all warranty information electronically in PDF format.
   2. Furnish Owner with two (2) sets of bound hard copy warranties.
   3. Submit to Architect for review of information and forwarding to Owner for Owner’s records.

B. Preparation:
   1. Gather Warranties required for specific Products or Work as specified in each individual Section.
   2. Obtain information directly from responsible Subcontractor, supplier, and manufacturer of equipment or product within 10 days after completion of applicable item of Work.
   3. Except for items put into use with Architect approval, leave date of beginning of time of warranty until the Date of Final Acceptance is determined.
   4. Verify that documents are in proper form, are complete, contain full information, are notarized, and are fully executed and valid.
   5. Co-execute submittals when required.
   6. Retain warranties until time specified for submittal.

C. Format:
   1. Prepare organization of data in the format of an instructional manual.
   2. Cover:
      a. Identify manual with title WARANTIES.
      b. Identify title of Project.
      c. Identify subject matter of contents.
   3. Organization:
      a. Separate each warranty keyed to the Table of Contents listing.
         Provide full information, using separate typed sheets as necessary.
      b. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
      c. For any hard copies required, provide tabbed dividers between each warranty.
   4. Binders (for any hard copies required):

a. Commercial quality, 8-1/2 x 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size.
b. When multiple binders are used, correlate data into related consistent groupings.

D. Contents, Each Volume:
1. Table of Contents:
Neatly typed, in sequence of Table of Contents of Project Manual, with each item identified with number and title of specification Section in which specified, and name of Product or Work item.

E. Time of Submittals:
1. For equipment or component parts of equipment put into service during construction with Architects approval, submit documents within 10 days after acceptance.
2. Make other submittals within 10 days after Date of Final Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Final Completion, submit within 10 days after acceptance.

1.04 PROJECT RECORD DRAWINGS ("AS-BUILTS")

A. Submission Requirements:
1. Furnish Owner with original record document prints.
2. Furnish Owner with one (1) additional hard copy set of record document prints.
3. Furnish Owner with all as-built information electronically in PDF format.
4. Submit to Architect for review of information and forwarding to Owner for Owner's records.

B. Project Record Documents required:
1. Marked-up copies of Contract Drawings.
2. Marked-up copies of Shop Drawings.
3. Marked-up copies of Specifications, addenda and Contract Modifications.
4. Marked-up Product Data submittals.
5. Field records for variable and concealed conditions.
6. Record information on Work that is recorded only schematically.

C. Maintenance of Documents:
Store record documents in field office apart from Contract Documents used for construction. Do not permit Project Record Documents to be used for construction purposes. Maintain and protect record documents from damage in a clean, dry, legible condition. Make documents available at all times for inspection by Architect.

D. Record Drawings:
1. During construction, maintain a set of black-line white-prints of Contract Drawings and Shop Drawings for Project Record Document purposes.
a. Mark these Drawings to indicate actual installation where installation varies from installation shown originally. Give particular attention to information on concealed elements which would be difficult to identify or measure and record later. Items required to be marked include but are not limited to:
1) Dimensional changes to Drawings.
2) Revisions to details shown on Drawings.
3) Depths of foundations below first floor.
4) Locations and depths of underground utilities.

5) Revisions to routing of piping and conduits.
6) Revisions to electrical circuitry.
7) Actual equipment locations.
8) Duct size and routing.
9) Locations of concealed internal utilities.
10) Changes made by Contract Modification.
11) Details not on original Contract Drawings.

b. Responsibility for Markup and Supervision:
Contractor Quality Control Representative; as specified in Section 01 45 00 - Quality Control. Where feasible, individual or entity who obtained record data, whether individual or entity is installer, subcontractor, or similar entity, is required to prepare mark-up on Record Drawings.
1) Accurately record information in an understandable Drawing technique.
2) Record data as soon as possible after it has been obtained. In case of concealed installations, record and check mark-up prior to concealment.
3) Contractor Quality Control Representative: Affix signature and certify accuracy of Record Drawings.

c. Mark completely and accurately record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.

d. Mark record sets with red erasable colored pencil; use other colors to distinguish between changes for different categories of Work at same location.

e. Mark important additional information which was either shown schematically or omitted from original Drawings.

f. Note construction change directive numbers, alternate numbers, Contract Modification numbers and similar identification.

g. At time of Final Acceptance, submit record Drawings to Architect for Owner records. Organize into sets, bind and label sets for Owner's continued use.

E. Additional Record Submittals:
1. Refer to other specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately prior to Final Acceptance, complete additional records and place in order, properly identified and bound or filed, ready for use and reference. Submit to Architect.
a. Categories of requirements resulting in miscellaneous records include, but are not limited to the following:
1) Field records on excavations and foundations.
2) Field records on underground construction and similar Work.
3) Survey showing locations and elevations of underground lines.
4) Inverted elevations of drainage piping.
5) Survey establishing building lines and levels.
6) Authorized measurements utilizing unit prices or allowances.
7) Records of plant treatment.
8) Ambient and substrate condition tests.
9) Certifications received in lieu of labels on bulk products.
10) Batch mixing and bulk delivery records.
11) Testing and qualification of tradesmen.
12) Documented qualification of installation firms.
13) Load and performance testing.
14) Inspections and certifications by governing authorities.
15) Leakage and water-penetration tests.

16) Fire resistance and flame spread test results.
17) Final inspection and correction procedures.

1.05 SPARE-PARTS

A. Provide Products, replacement stock, spare parts, maintenance, and extra materials in quantities specified in individual specification Sections.

B. Deliver to Project Site and place in location as directed by Architect; obtain receipt prior to Final Payment.

1.06 CERTIFICATES OF INSPECTION

A. General.
B. Plumbing.
C. HVAC.
D. Electrical.
E. Fire Sprinkler.
F. Fire Alarm.
G. Exhaust Hood.

1.07 FOOD SERVICE EQUIPMENT MAINTENANCE MANUALS:

A. Furnish Owner with three (3) separately bound "Food Facilities Equipment Maintenance Manual" for all kitchen equipment, exhaust hoods and specialties. Submit manual to Architect for review and forward to Owner.

B. Instructions for maintenance of food facilities equipment, including the following:
   1. Care of finished surfaces.
   2. Spare parts lists.
   3. Data Sheets.
   4. Period of warranty and date warranty goes into effect.
   5. List of service agencies responsible for each item of equipment including fabricated equipment.
   6. Food Service Equipment Contractor's name and telephone number.

1.08 KEYS

A. Submit keys and keying schedule to Owner.

1.09 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in the operation, adjustment, and maintenance of all products, equipment and systems.

B. Such instructions shall occur at a time designated by the Architect/Engineer at the completion of the job at a meeting set up by the contractor and attended by the representatives of the Owner and manufacturer.

C. Services of factory instructor or representative to teach Owner's representative on operation of equipment will be arranged by the contractor, shall begin after equipment has been placed in satisfactory operating condition and shall continue for a period of time as deemed necessary by the Architect.

D. Contractor shall verify in writing that such periods of instruction have been held with the Owner's representative.

E. Minimum length of training session to be two (2) hours.

F. Session will need to be videotaped by Contractor for use by Owner.

G. Notify Architect to attend all training sessions.

1.10 CERTIFICATE OF OCCUPANCY

A. Where the Local Authority of Location of project requires either temporary or permanent Certificate of Occupancy, obtain and pay for Certificates and furnish a copy to the Architect for forwarding to the Owner.

B. Contractor to verify requirements with Local Building Officials.

1.11 CERTIFICATION OF ASBESTOS MATERIAL AND LEAD-BASED PAINT

A. The use of asbestos containing materials, in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, is prohibited in the project.

B. The use of lead-based paint is prohibited in the project.

C. Prepare and submit to Architect the "Certification of Asbestos and Lead-Based Paint (New Work) " for new material furnished or installed as part of the Work (attached).

END OF SECTION 01 78 00

Certificate of Asbestos and Lead-Based Paint

(New Work)

To: TowerPinkster

Subject: Certification for new construction

Facility name:

_____

Facility address:

_____

Certification for new construction:

This Contractor hereby certifies that no asbestos-containing material in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, and lead-based paint has been furnished or installed at the referenced project.

Contractor name:

_____

Signature:

_____

Address:

Telephone: _____

Date executed: _____

The penalty for making a false statement is prescribed by 18 USC 1001.

SECTION 01 78 46 - CLOSEOUT MAINTENANCE MATERIALS

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Maintenance Materials.
   2. Owner Verification.

1.02 MAINTENANCE MATERIALS

A. General Requirements:
   1. No maintenance stock to be used by the Contractor for any reason.
   2. Provide maintenance stock for each and every style, type or color specified for each product.
   3. Provide maintenance stock at end of the project and directly to the Owner.
   4. Wrap and protect all materials for storage by the Owner.
   5. Packages and containers to be manufacturer's unopened and unsealed packaging. If quantities listed exceed a manufacturer's single container, additional unopened and unsealed containers shall be supplied until minimum quantity is met.
   6. Packages and containers shall include manufacturer's label and product information.
   7. Paint products shall include manufacturer's color and mix formulas.

B. Porcelain Tile:
   1. Provide to Owner maintenance stock of at least (8) floor tiles.
   2. Provide to Owner maintenance stock of at least (8) base tiles.
   3. Provide to Owner maintenance stock of at least (8) wall tiles.

C. Acoustical Ceiling Tile:
   1. Provide to Owner maintenance stock of at least (24) tiles.

D. Vinyl Composition Tile Flooring:
   1. Provide to Owner maintenance stock of at least (10) tiles.

E. Luxury Vinyl Tile Flooring:
   1. Provide to Owner maintenance stock of at least (10) tiles.

F. Rubber Base:
   1. Provide to Owner maintenance stock of at least (20) linear feet.

G. Modular Carpet Tiles:
   1. Provide to Owner maintenance stock of at least (6) tiles.

H. Rubber Stair Treads:
   1. Provide to Owner maintenance stock of at least (3) treads.

I. Paint:
   1. Provide to Owner maintenance stock of at least (2) unopened gallon containers.

J. Wall Covering:
   1. Provide to Owner maintenance stock of at least (100) square feet.

1.03 OWNER VERIFICATION

A. Owner to sign-off receipt of each item.

B. Provide to Architect, copy of this Specification Section with Owner's signature next to each item listed, verifying that they have been received by the Owner's representative and entered into their stock.

END OF SECTION 01 78 46

SECTION 02 30 00 - SUBSURFACE EXPLORATION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Sub-Surface Exploration Report:

1. Prepared by: **ASHER ENGINEERING INC.**
1021 S. FLOYD STREET
LOUISVILLE, KY 40203
(502) 589-0073
asherinc@aol.com

2. Report is intended for informational purposes of interpolating and understanding subsurface conditions of the project site, and becomes a part of the Contract Documents.

B. Boring Logs:

1. Included for Contractor's information, but not a warranty of subsurface conditions.

C. Representations or Warranties:

1. None are made by the inclusion of this report.
2. Neither the Owner nor the Architect//Engineer will be responsible for interpretations or conclusions drawn from this report by the Contractor.
3. Data is made available solely for the convenience of the Contractor.

D. Additional Investigation:

1. Contractor should visit the site to acquaint himself with site conditions.

END OF SECTION 02 30 00

GEOTECHNICAL ENGINEERING STUDY

N. HARRISON ELEM SCHOOL – KITCHEN BUILDING

1115 W. WHISKEY RUN ROAD NW
RAMSEY INDIANA

ASHER PROJECT NO. 23-122

Prepared For:

TowerPinkster
630 Walnut Street
Jeffersonville, IN 47130
Prepared By:

Asher Engineering, Inc.
1021 S. Floyd Street
Louisville, Kentucky 40203

January 2, 2024

Asher Engineering, Inc.
Environmental & Engineering Consulting

January 2, 2024

TowerPinkster
630 Walnut Street
Jeffersonville, IN 47130

Re: Geotechnical Engineering Report
N. Harrison Elem School – Kitchen Building
1115 W. Whiskey Run Road NW
Ramsey, IN 47166

Asher Engineering has completed a Geotechnical Engineering Study for the referenced project. This report contains the findings of our subsurface exploration, geotechnical recommendations to aid design of foundations, and pavements, and construction recommendations with regard to sitework; fill placement, and foundation installation and inspection.

We appreciate the opportunity to be of service to you on this project. If we can be of further assistance, or if you have any questions regarding this report, please contact our office.

Sincerely,

Richard A. Linker, P. E.
Indiana PE 19400375

Austin Horvat
Project Engineer

TABLE OF CONTENTS

1.0 PROJECT INFORMATION

The proposed Kitchen Addition is located at the southwest corner of the existing Elementary School building, 1115 W. Whiskey Run Road, in Ramsey IN. The new Kitchen Building is a 1,700 sf one story addition. The new construction area is currently a flat grass lawn to the east, and an asphalt paved driveway to the west. A review of historical aerial photographs revealed the existing school in a 1983 ariel photograph. Undeveloped farmland was noted in a 1966 photograph.

2.0 SUBSURFACE EXPLORATION

The subsurface conditions were explored by conducting 1 test borings (Boring 2) at the location shown on the sketch in the Appendix. Two borings were planned for the exploration; however, Boring 1 was canceled due to concern for possible underground utilities in the area. The Boring 2 log (also included in the Appendix) describes the materials and conditions encountered at the Boring 2 location.

Boring 2 encountered a 7 in. topsoil layer at the ground surface. The topsoil is underlain by about 6 ft. of very firm, moist, brown soil fill with a trace rock. The fill material is underlain by stiff, moist, red brown Silty Clay (CL) soil. The Silty Clay was encountered to refusal 11 ft. below existing grade. No water was encountered in the test boring.

3.0 DESIGN RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions.

3.1 Site Development

The test boring encountered old fill material to about 6 ft. depth. The fill consists of very firm silty clay soil with trace rock. Footing excavations for the new building must extend down through any old fill or soft soil to firm natural soil. Any undercut footings can be backfilled with compacted Ky No. 57 stone (or flowable fill) to re-establish the planned bottom footing elevation. The old fill material can remain in place under floor slabs provided the areas are firm under a proofroll inspection with a loaded truck. Any soft areas identified by the proofroll would be undercut and stabilized with crushed limestone or suitable clay soil.

3.2 Shallow Foundations

Footings can be proportioned using a net allowable bearing capacity of 3000 psf for continuous wall and isolated footings. Site Classification C should be used for seismic design. Wall footings must be at least 16 in. wide and column footings must be at least 24 in. wide to provide an adequate factor of safety for bearing capacity. All exterior footings and footings in unheated areas must bear at least 24 in. below final exterior grade for frost protection. Interior footings in heated areas can bear at nominal depths below the floor (at least 12 inches).

3.3 Floor Slabs

The geotechnical engineer should inspect the subgrade with a proofroll prior to the placement of fill or the crushed stone base. Some undercutting and stabilization with crushed stone may be necessary to stabilize the slab area, especially during wet periods of the year. Upon approval of the subgrade, we recommend that the slabs be supported on a 4-in. layer of KY DGA crushed stone compacted to 100 percent of the standard Proctor.

4.0 CONSTRUCTION RECOMMENDATIONS

Variations in subsurface conditions must be expected during construction. It is therefore recommended that the geotechnical engineer be retained to review the soils-related phases of the project and to correlate the subsurface data with the soil conditions that are encountered during construction.

4.1 Subgrade Preparation

Prior to construction or the placement of new engineered fill, the exposed subgrade should be evaluated by the project geotechnical engineer. The evaluation should include proofrolling of the exposed subgrade with a loaded dump truck. If unsuitable material were disclosed, the geotechnical engineer would recommend an appropriate remedial measure at that time. The silty clay soils encountered just beneath the pavement surface will be sensitive to moisture and heavy construction equipment, and may require aeration and re-compaction or undercutting to reach firm subgrade. The severity of this potential problem depends on the weather conditions prevailing during construction.

4.2 Engineered Fill

Engineered fill should be placed on a prepared subgrade that has been evaluated by the geotechnical engineer. Engineered fill placed in the building pad should be compacted to at least 98 percent of the standard Proctor maximum dry density (ASTM D-698). Fill placed in paved areas may be compacted to 95 percent; and fill placed in landscape (green) areas may be compacted to 90 percent. The geotechnical engineer or his representative should monitor engineered fill placement and compaction operations. Field density tests should be performed on each lift as necessary to insure that the specified compaction is being achieved. Fill should be placed in horizontal lifts and each lift should be compacted to the specified density. Lift thickness of 8 in. and 12 in. should be used for clayey soils and granular soils, respectively.

4.3 Foundation Excavations

All foundation excavations should be evaluated by the geotechnical engineer or his representative to insure adequate foundation support.

All concrete for foundations should be poured the same day the excavation is made. If this is not practical, the foundation excavation should be adequately protected.

5.0 QUALIFICATIONS

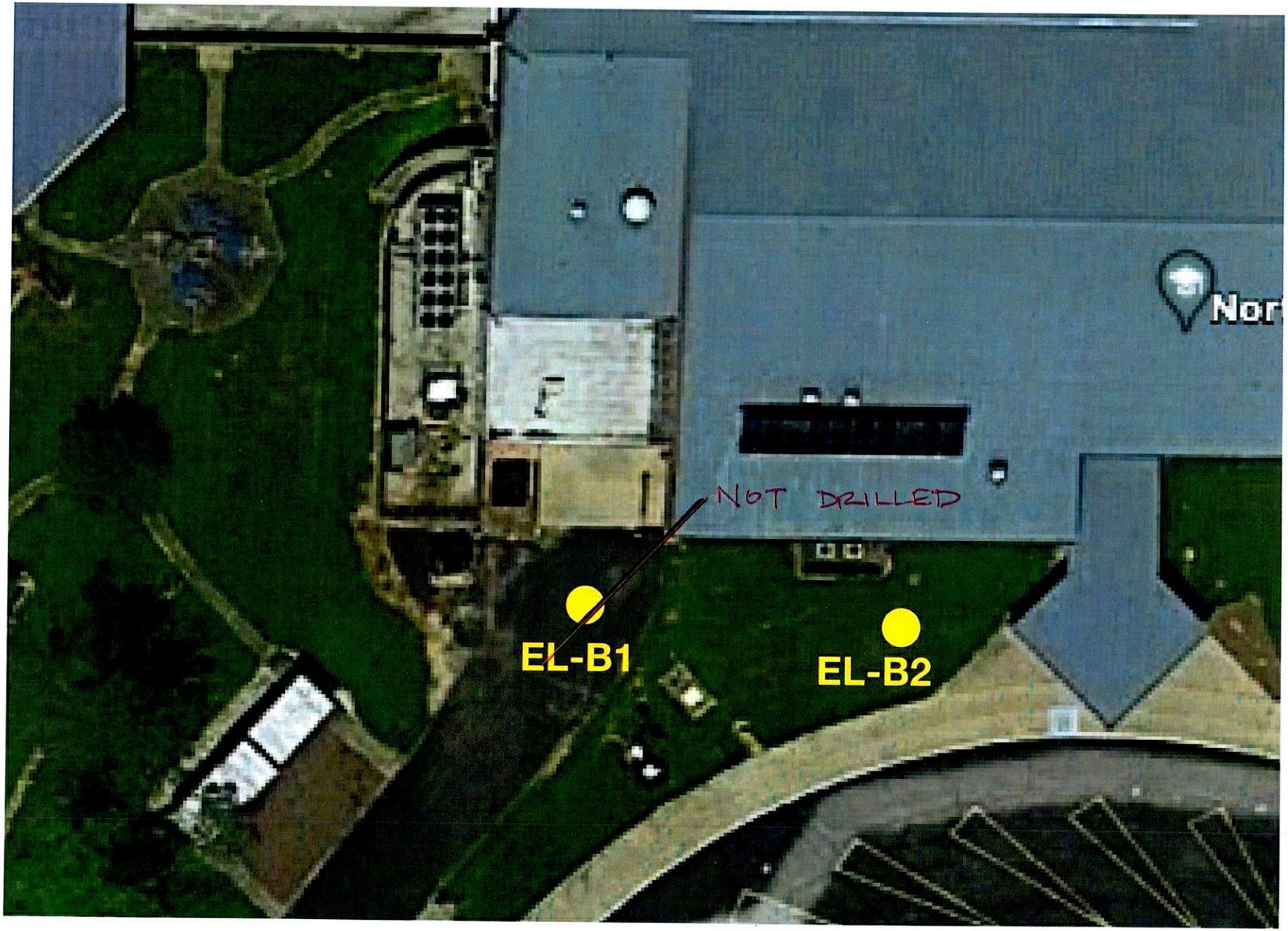
Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either express or implied. Asher, Inc. is not responsible for the independent conclusion, opinions or recommendations made by others based on the field exploration and laboratory test data presented in this report.

The nature and extent of variation and change in the subsurface conditions at the site may not become evident until the course of construction. Construction monitoring by the geotechnical engineer or his representative is therefore considered necessary to verify the subsurface conditions and to check that the soil connected construction phases are properly carried out. If significant variations or changes are in evidence, it may then be necessary to reevaluate the recommendations of this report.

Furthermore, if the project characteristics are altered significantly from those discussed in this report, if the project information contained in this report is incorrect, or if additional information becomes available, a review must be made to determine if any modification in the recommendations will be required.

APPENDIX

Location of Test Borings
Test Boring Logs


NOT DRILLED
EL-B1
EL-B2

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 2

ELEV.: 738
Project: North Harrison Elem Kitchen **Project No.:** 23-123
Location: Ramsey, Indiana
Client: Kovert Hawkins **Date:** December 6, 2023

Elev (feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Percent Moisture	Description of Material
						Topsoil - 7"
		1	3 6 3	9		Fill- Stiff, moist, brown clay soil, trace rock
		2	6 28 13	41		Fill - Very Hard, moist, brown clay soil with rock
	5					
		3	6 5 7	12		Silty Clay (CL) - stiff, moist, brown
	10	4	6 4 6	10		Silty Clay (CL) - stiff, moist, brown
						Augar Refusal at 11'
	15	5				
	20					
	25					

Notes: Boring Location offset 4' west

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Selective Demolition work included in project.
2. Project demolition conditions.
3. Electrical, Plumbing and HVAC Demolition.
4. Utility demolition.
5. Subsurface filling.
6. Protection.

1.02 WORK INCLUDED

A. The extent of demolition work shown on drawings and specified herein, including, but not limited to:
1. Opening of exterior walls for new doors, windows, grilles, louvers, mechanical, and electrical and providing weather-tight enclosures.
2. Opening of interior walls, ceilings and floors necessary for proper installation of new materials, equipment, mechanical or electrical items.
3. Removing interior walls, ceilings, floor finishes.
4. Removing doors and frames.
5. Removing casework and equipment.
6. Removing existing HVAC system and components, both exposed to view and concealed.
7. Removing existing plumbing fixtures, piping and components, both exposed to view and concealed.
8. Removing existing lighting and electrical distribution, switches, outlets, conduit and other devices both exposed to view and concealed.

B. Interior demolition includes complete wrecking of interior partitions, finishes and structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

C. The Owner shall have the option of retaining any item removed. The Contractor shall deliver these items to the Owner's designated storage area. Any items not retained by the Owner shall be disposed of offsite by the Contractor. All items are to remain property of the Owner unless specifically designated otherwise.

D. Some removed items are to be salvaged for re-use. Drawings indicate extent of such work.

PART 2 - PRODUCTS

Not Applicable

PART 3 - EXECUTION

3.01 PROJECT DEMOLITION CONDITIONS

A. Conditions of Structures:
1. The Owner assumes no responsibility for actual conditions of structures to be demolished.

B. Conditions of the structure existing at time of inspection for bidding purposes will be maintained by Owner in so far as possible. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work.

C. Pollution Controls:
1. Use water sprinkling, temporary enclosures, and other suitable methods to limit dust and dirt rising

and scattering in air to lowest practical level.
2. Comply with governing regulations pertaining to environmental protection.

D. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.

E. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to condition existing prior to the start of work.

F. Partial Removal:
1. Items of salvable value to Contractor, and not retained by Owner, may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.
2. Storage or sale of removed items on site will not be permitted.
3. Store items noted on drawings and specified to be salvaged for use in the project, so as to prevent damage or deterioration.

G. Disposal of Demolished Materials:
1. Remove from site debris, rubbish, and other materials resulting from demolition operations. Pay all fees related to removal and dumping.
2. Remove and dispose of interior demolition debris off job site.
3. Burning of removed materials from demolished structures will not be permitted.
4. Transport materials removed from demolished structures and dispose of off site.

H. Traffic:
1. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, occupied areas, and other adjacent occupied or used facilities.
2. Do not close or obstruct streets, walks or other occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

I. Protections:
1. Ensure safe passage of persons around or through area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons. Provide protection in accordance with ANSI/NFPA 241.
2. Erect temporary covered passageways as required by the Owner or authorities having jurisdiction.

J. Use of explosives will not be permitted.

K. Provide temporary enclosures at doors and other penetrations in walls, necessitated by weather and demolition conditions, and where dust proof partitions are indicated. Enclosures shall be constructed with fire retardant treated lumber, insulated and painted. Joints shall be taped and caulked to prevent dust and debris from migrating beyond construction areas. Maintain enclosures in good repair and remove when no longer needed. Extend partitions to deck.

L. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures to be demolished and adjacent facilities to remain.

M. Repair any damage to property which is to remain in use, or that of any person, or persons on or off site caused by the demolition work without additional expense to Owner.

N. Use of jackhammers during normal operating hours of the facility will not be permitted.

O. Where a portion of construction (walls, floors, ceilings, etc.) is indicated to be removed, demolition shall

include the removal of any and all items either surface-mounted on it, or concealed within it, unless otherwise indicated to remain or be salvaged for reuse.

3.02 ELECTRICAL

A. Visit the site before submitting a bid to observe existing conditions.

B. Work in existing building shall be scheduled well in advance with the Owner. Work shall be performed at such times and under such conditions as suit the convenience of the Owner. Plan the Work to minimize disruption of normal operations.

C. Remove wiring devices, fixtures, components, electrical equipment, conductors, boxes and conduits not required to remain in service in remodeled areas when this Project is complete.

D. Reconnect circuits to other panelboards when necessary to complete the renovation.

E. Remove existing conduit and wire from areas to be remodeled, back to panelboard, cabinet or junction box. Where such Work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the Work.

F. When outlets are covered up or are otherwise rendered inaccessible, all wiring shall be removed to the source. If a circuit that must remain in service is interrupted, it shall be reconnected by the most inconspicuous means so that it remains operational, with the same capacity as before. All building surfaces damaged, and openings left by removal of boxes, conduit, or other equipment shall be repaired. All holes left in junction boxes, switches, panels and other equipment shall be closed.

G. Where new openings are cut and concealed conduits or other electrical items are encountered, they shall be removed or relocated as required. Where conduit to be removed stubs through floors, walls, and ceilings, such conduit shall be removed to the point where the finished surfaces can be patched so that no evidence of the former installation remains.

H. Where a circuit is interrupted by removal of a device or fixture from that circuit, install wire and conduit as required to restore service to the remaining devices and fixtures on that circuit. If the interrupted piping is concealed in walls or under floors, an alternate route may be required.

I. Lighting fixtures, wiring devices, panelboards, and conductors removed shall be offered to the Owner's Representative. If he chooses to retain these items or a part of these items, turn those chosen over to him. Items rejected by Owner's Representative shall be removed from the project site by the Contractor.

3.03 PLUMBING

A. Visit the site before submitting a bid to observe existing conditions.

B. Work in existing building shall be scheduled well in advance with the Owner. Work shall be performed at such times and under such conditions as suit the convenience of the Owner. Plan the Work to minimize disruption of normal operations.

C. Remove piping, fixtures, components, valves, insulation and fittings not required to remain in service in remodeled areas when this Project is complete.

D. Reconnect piping to provide service when required to complete the renovation.

E. Remove existing piping from areas to be remodeled, back to service branch. Where such Work would not be possible without disturbing areas not being renovated, consult with the Architect prior to

performing the Work.

F. When outlets are covered up or are otherwise rendered inaccessible, all piping shall be removed to the source. If a fixture that must remain in service is interrupted, it shall be reconnected by the most inconspicuous means so that it remains operational, with the same capacity as before. All building surfaces damaged, and openings left by removal of fixtures, piping, or other equipment shall be repaired. All holes left shall be closed.

G. Where new openings are cut and concealed piping or other plumbing items are encountered, they shall be removed or relocated as required. Where piping to be removed stubs through floors, walls, and ceilings, such piping shall be removed to the point where the finished surfaces can be patched so that no evidence of the former installation remains.

H. Where piping is interrupted by removal of a piping or fixture, install piping as required to restore service to the remaining fixtures on that service line. If the interrupted circuit is concealed in walls or under floors, an alternate route may be required. If the interrupted piping is concealed in walls or under floors an alternate route may be required.

I. Plumbing fixtures, valves, and gages removed shall be offered to the Owner's Representative. If he chooses to retain these items or a part of these items, turn those chosen over to him. Items rejected by Owner's Representative shall be removed from the project site by the contractor.

3.04 HVAC

A. Visit the site before submitting a bid to observe existing conditions.

B. Work in existing building shall be scheduled well in advance with the Owner. Work shall be performed at such times and under such conditions as suit the convenience of the Owner. Plan the Work to minimize disruption of normal operations.

C. Remove piping, ductwork, equipment, components, valves, insulation, fittings and controls not required to remain in service in remodeled areas when this Project is complete.

D. Reconnect piping and ductwork to provide service when required to complete the renovation.

E. Remove existing piping and ductwork from areas to be remodeled, back to service branch. Where such Work would not be possible without disturbing areas not being renovated, consult with the Architect prior to performing the Work.

F. When grilles and diffusers are covered up or are otherwise rendered inaccessible, all ductwork shall be removed to the source. If an HVAC equipment item which must remain in service is interrupted, it shall be reconnected by the most inconspicuous means so that it remains operational, with the same capacity as before. All building surfaces damaged, and openings, left by removal of grilles, piping, or other equipment shall be repaired. All holes left shall be closed.

G. Where new openings are cut and concealed piping, ductwork, or other HVAC items are encountered, they shall be removed or relocated as required. Where piping, ductwork or controls to be removed stubs through floors, walls and ceilings, such items shall be removed to the point where the finished surfaces can be patched so that no evidence of the former installation remains.

H. Where piping or ductwork is interrupted by removal of a branch or equipment, install material as required to restore service to the remaining items on that service line. If the interrupted piping or duct is concealed in walls or under floors, an alternate route may be required.

I. HVAC equipment, valves, and gages removed shall be offered to the Owner's Representative. If he chooses to retain these items or part of these items, turn those chosen over to him. Items rejected by Owner's Representative shall be removed from the project site by the Contractor.

J. Equipment removed from roof shall include curbs, sleepers, flashing boxes, etc. Install new roof decking to match existing. Install roof insulation and matching membrane system to maintain any roof warranties.

K. Equipment removed from finished interior spaces shall include patching and restoration to match all adjacent finishes.

L. All temperature controls shall be maintained, rerouted, reconnected, or reprogrammed to maintain operation of HVAC equipment.

3.05 UTILITY DEMOLITION

A. Utility Services:
1. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.
2. Allow no interruption in service unless coordinated with Owner at least 72 hours in advance.

B. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.

C. Disconnect and seal utilities serving each structure to be demolished, or interior area to be demolished, prior to start of demolition work.

D. If utility service or other services to an occupied area (such as emergency power, heating, medical gas, air conditioning), are to be disconnected, provide temporary or alternative service to that area.

E. Cap all utility lines terminated by the demolition work in a manner approved by the governmental authorities and utility companies having jurisdiction.

F. Mark location of disconnected utilities. Identify and indicate capping location on project record documents.

3.06 SUBSURFACE FILLING

A. Filling Basement and Voids:
1. Completely fill below-grade areas and voids resulting from demolition of structures.
2. Perform filled and compaction in accordance with requirements of Section 31 00 00 - Earthwork.

3.07 PROTECTION

A. Provide temporary construction in accordance with requirements of Section 01 53 00 - Temporary Construction as required in all areas of demolition work.

B. Provide levels of protection as deemed necessary by Owner for protection of public into space, project, and site.

END OF SECTION 02 41 19

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, material, equipment, special tools, supervision and services required to deliver and properly place and complete all cast-in-place concrete work, both plain and reinforced, indicated, noted and detailed on the drawings and specified herein, including (but not limited to) reinforcing steel, anchor bolts, forms, and form removal.

B. 15 mil Vapor Barrier Systems throughout the project.

1.02 QUALITY ASSURANCE

A. Comply with the following standards:
   1. ACI Standards (latest editions) for construction procedures. Including but not limited to:
      a. Specifications for Structural Concrete for Buildings (ACI-301-05).
      b. Recommended Practice for Hot Weather Concreting (ACI-305).
      c. Recommended Practice for Cold Weather Concreting (ACI-306).
      d. Building Code Requirements for Reinforced Concrete (ACI-318-02).
      e. Guide To Evaluation of Strength Test Results Of Concrete (ACI-214).
      f. ACI 302.2: Guide for Concrete Slabs that Receive Moisture-sensitive Flooring Materials.
   2. ASTM Standards (latest editions) for material specifications.

B. Testing:
   1. See Section 01 45 00 - Quality Control.
   2. Pay costs of geotechnical engineer and testing laboratory approved by the Architect/Engineer, tests, inspections and necessary re-testing and re-inspection.
   3. Perform following tests, by certified concrete field technician.
      a. Selection and securing of samples ..... ASTM C172
      b. Air content*……..ASTM C231 or ASTM C173
      c. Slump test*……..ASTM C143
      d. Cylinders - Five - 6" x 12" ……...ASTM C31
      e. Cylinder Test*……ASTM C39
      *Results to be reported by laboratory on test reports
   4. Concrete Cylinders:
      a. Taken for each 50 cubic yards or each day's pour if less than 50 yards.
      b. Remain undisturbed in a secure location on the site for 24 hours after which they shall be removed to the testing lab by laboratory personnel.
      c. Two of the cylinders shall be tested at 7 days and two at 28 days for acceptance.
      d. One cylinder shall be kept in reserve for 56-day test if needed.
      e. Testing reports shall be made directly by laboratory as follows:
      -One copy to Architect
      -One copy to Contractor
      -One copy to Ready Mix Producer
      f. Failure of the concrete to meet the specification requirement's may result in its complete removal and replacement at the Contractor's expense.
      g. Cost of re-test, if any, will be at the Contractor's expense.

C. Test Failure:
   1. In the event results do not meet the specification requirements, one or more of the following will be required at no cost to the Owner:
      a. Windsor Probe test conforming to ASTM C803.

b. Core-boring test conforming to ASTM C42.
c. Load test in accordance with Chapter 20, ACI 318-05.

2. In event Windsor Probe, core-boring or load test indicates concrete does not conform to specifications, contractor shall take such measurements as Architect prescribes or remove defective work as directed by Architect.

D. Allowable Tolerances:
1. The surface plane tolerance for cast slabs shall be such that depressions between high spots are not greater than 1/8" under a 10 foot straight-edge.
2. Slabs on grade overall floor flatness and levelness minimums: $F_F = 35$ and $F_L = 25$.
3. Minimum local values: $F_F = 25$ and $F_L = 15$.
4. Concrete floor tolerances shall be tested within 72 hours after floor installation. Testing procedures shall comply with ASTM E1155 “Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers”. An Independent Testing Laboratory shall be retained by the Contractor to provide floor tolerance testing.

E. Footings and Slabs On Grade:
1. All footing excavations shall be inspected by the geotechnical engineer and testing laboratory before concrete is placed. The adequacy of the soil shall be determined.
2. Footings and slabs on grade shall bear on firm natural soil, or on properly compacted engineered fill over firm natural soil, as recommended by the geotechnical engineer.
3. Engineered fill and backfill under all footings and slabs on grade shall be placed and compacted as recommended by the geotechnical engineer.

1.03 DELIVERY, STORAGE AND HANDLING
A. Store materials to prevent contamination, deterioration, and weather damage.

B. Deliver ready-mixed concrete to destination in conformance with ASTM C94.

1.04 ENVIRONMENTAL REQUIREMENTS
A. Cold Weather:
1. Comply with ACI 306.
2. Temperature of concrete when placed shall not be less than 50°F.
3. Maximum concrete temperature 90°F, minimum 50°F per ASTM C94, for duration of curing period.
4. Concrete shall be placed within 90 minutes of batch time.

B. Hot Weather:
1. Comply with ACI 305.
2. Temperature of concrete when placed shall not be greater than 90°F.
3. Maximum concrete temperature 90°F, for duration of curing period.
4. Concrete shall be placed within 90 minutes of batch time. Shorter time limits may apply when air temperature is in excess of 90°F.
5. Protect from rapid evaporation by spraying or sheeting.

C. The Contractor shall consider the timing required for placement of concrete for the entire project. He shall include in his bid all work and costs associated with the proper protection, procedures and materials required for the weather and environmental conditions for the time of year the work is to occur. No additional costs will be borne by the Owner, Architect or their consultants for failure by the Contractor to include these costs in the bid or make reasonable assumptions as to the requirements needed or limitations that may be incurred.

1.05 SUBMITTALS

A. Concrete Mix Designs:
   1. A separate mix design for each class and type of concrete is required.
      a. Include literature for admixtures.
      b. Include applicable compliance with referenced ASTM number.

B. Reinforcing Steel Shop Drawings:
   1. Indicate all reinforcing steel sizes, locations, supports, details, lengths laps and bends.
   2. Indicate all reinforcing strengths and quantities.

C. Vapor Barrier Product Data:
   1. Submit manufacturer's published literature describing products and system.
   2. Submit manufacturer's installation procedures and MSDS sheets.

D. Curing and Sealing Materials Product Data:
   1. Submit manufacturer's published literature describing products.
   2. Submit manufacturer's installation procedures and MSDS sheets.

PART 2 - PRODUCTS

2.01 MIX DESIGNS

A. Design mix with appropriate adjustments for air content and aggregate proportions.

B. Compressive Strength (minimum) reached by 28 days:
   1. 4,000 psi: All concrete for general use, interior and exterior, unless indicated otherwise.
   2. 3,500 psi: Curbing.

C. Air Entrainment:
   1. For exterior concrete slabs exposed to weather: Controlled between 4%-6% by volume.
   2. **DO NOT USE** for interior concrete and site-cast tilt-walls.
   3. Comply with ASTM C260.

D. Slump:
   1. Footings: 3 inches +/- 1 inch.
   2. Foundation walls: 4 inches +/- 1 inch.
   3. Interior slabs on grade and slabs over metal decking: 4 inches +/- 1 inch.
   4. Exterior slabs, pads, walks, steps and stoops: 4 inches +/- 1 inch.
   5. Curbs: 1 inches +/- .5 inch.
   6. When water reducing admixtures are used: 7.0 inches maximum.

E. Water / Cement Ratio:
   1. Maximum water to cement ratio for all interior slabs (on grade or over metal decking) to be 0.50.
   2. Regardless of any contrary notes on Drawings, in no case shall the water to cement ratio exceed this amount for slabs scheduled to receive floor finishes. Provide admixtures as required for weather conditions at time of pour.
   3. If water to cement ratio exceeds this amount in quality control test, that area of slab must be removed at contractor's expense, the mix design corrected as required, and a new slab installed which complies with the proper water to cement ratio. All admixtures required are to be included in the corrected mix design submittal.

F. Cement Content:

1. Minimum cement content: 564 lb. per cu. yd., unless the supplier can substantiate with test data that a lower content is acceptable to achieve specified compressive strength per mix design.

2.02 CONCRETE MATERIALS

A. Portland Cement:
   1. ASTM C150-05, Type 1.
   2. One brand shall be used throughout the work.

B. Air Entraining Cement:
   1. ASTM C150, Type IA or IIIA.

C. Aggregates:
   1. ASTM C33:
   2. Coarse Aggregates:
      a. Clean, tough, durable fragments of crushed stone, uncrushed gravel or dredged river gravel free from dirt or objectionable matter.
      b. Size: Maximum 1-1/2" at footings; 1" in slabs.
   3. Fine aggregate: Natural sand; clean, sound, hard, durable particles; gradation size No. 1.

D. Water:
   1. Clean, potable and free from injurious amounts of oil, acids, alkalies, organic matter or deleterious substances.

E. Fly Ash/Pozzolans:
   1. ASTM C618.
   2. Class F or C.
   3. Content shall not exceed 20% by weight of the total cementitious content of the mix.
   4. If used in conjunction with Ground Granulated Blast Furnace Slag, the total content of Fly Ash and Ground Granulated Blast Furnace Slag shall not exceed 50% by weight of the total cementitious content of the mix.

F. Ground Granulated Blast Furnace Slag:
   1. ASTM C989.
   2. Content shall not exceed 30-40% by weight of the total cementitious content of the mix.
   3. If used in conjunction with Fly Ash, the total content of Fly Ash and Ground Granulated Blast Furnace Slag shall not exceed 50% by weight of the total cementitious content of the mix.

2.03 ADMIXTURES

A. Air Entraining Agent:
   1. ASTM C260.
   2. Neutralized vinsol resin solution.

B. Water Reducing Agent:
   1. ASTM C494.
   2. Types as required to provide controlled setting and/or controlled rate of hardening without increase in water/cement ratio or loss in strength.

C. Chemical Accelerators and Retarders:
   1. ASTM C494.
   2. Permitted only upon approval of Architect/Engineer.

D. Prohibited Admixtures:

1. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are NOT permitted.

2.04 MIXING

A. Measure and mix materials for ready mixed concrete in conformance with ASTM C94.

B. Take into account free moisture in the aggregate weight.

2.05 CURING MATERIALS

A. Provide one of the following acceptable products:
1. “BASF/Sonneborn”; Kure-N-Seal WB.
2. “Foxfire International”; Foxfire P-1007 Sealer.
3. “Master Builders”; Masterseal.
4. “W.R. Grace”; Clear Seal.
5. “W.R. Meadows/Sealtight”;, VOCOMP-20.
6. “The Euclid Chemical Company”; Super Diamond Clear VOX.

B. Liquid Membrane: AASHTO M-148 and ASTM C309, Type 1, class A and B.

C. Waterborne acrylic polymer in a co-solvent emulsion, transparent, quick drying, non-yellowing.

D. Compatible with flooring adhesives.

2.06 METAL REINFORCEMENT

A. Bars: ASTM A 615 Grade 60, Type "S", deformed.

B. Deformation: ASTM A305.

C. Stirrups and Column Ties: ASTM A 615 Grade 60.

D. All Other Reinforcement: ASTM A 615 Grade 60, with supplementary requirements (S1).

E. Welded Wire Reinforcement (WWR), Welded Wire Fabric (WWF), Welded Wire Mesh (WWM):
1. ASTM A 185.
2. 6 x 6 W1.4 x W1.4, or as otherwise indicated.
3. All splices shall be Class B tension lap splice.

F. Metal Accessories:
1. Including spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing and supporting all reinforcement in place shall be provided.
2. Ties shall be of such type as to leave no metal closer than 3/4" from concrete surface.

2.07 VAPOR BARRIER

A. Provide one of the following acceptable products:
a. “Stego Industries”; Stego Wrap.
b. “Reef Industries”; Vapor Guard.
c. “Viper”; VaporCheck II.
d. “W.R. Meadows”; Perminator.
e. “Raven Industries”; Vaporblock VBLP15.

B. 15 mil polyethylene or polyolefin film slab underlay system.

C. System shall be comprised of manufacturer's tested assembly of vapor barrier film, seaming tape and penetration sealer tape, sealant or mastic.

D. Shall meet the following minimum requirements:
   1. Classification: Class A per ASTM E1745-11.
   2. Tensile Strength: 70 lbs/in per ASTM E154 / ASTM D882.
   3. Puncture Resistance: 2,200 grams per ASTM D1709.
   4. Permeance: Shall not exceed .01 perms as tested after conditioning per ASTM E154. (as per the definition of a vapor barrier in lieu of a vapor retarder).

2.08 EXPANSION JOINT FILLER

A. Provide one of the following acceptable products:
   1. "BASF/Sonneborn"; Expansion-Joint Filler.
   2. "W.R. Meadows/Sealtight"; Fibre Expansion Joint.

B. Pre-molded joint filler strips of resilient, flexible, closed cell, compressible, re-expanding, non-extruding material backing for sealants.

2.09 NON-SHRINK GROUT

A. Provide one of the following acceptable products:
   1. "Euclid Chemical Co.", NS Grout.
   2. "BASF", Masterflow 713.

B. Pre-mixed, factory-packaged, non-staining, non-shrink, non-metallic, non-gassing mortar grouting compound.

C. ASTM C827, C191, C109, and C1107.

D. Minimum compressive strength: 5,000 psi

E. Provide test data that grout when placed at a fluid consistency shall achieve 95% bearing under a 4' x 4' base plate.

2.10 BONDING AND REPAIR MATERIALS

A. Bonding Compounds:
   1. Polyvinyl acetate type.
   2. Provide one of the following acceptable products - Rewettable:
      (Use only in areas not subject to moisture):
      a. "Euclid Chemical Co."; Euco Weld.
      b. "Larsen Co."; Weldcrete.
   3. Provide one of the following acceptable products - Non-rewettable polymer modified compound:
      a. "Euclid Chemical Co."; Euco-Bond.

B. Epoxy Adhesive:
   1. Two component, 100% solids, 100% reactive compound.
   2. Suitable for use on dry or damp surfaces.
   3. Provide one of the following acceptable products:
      a. "Euclid Chemical Co."; Euco Epoxy No. 452MV.
      b. "Euclid Chemical Co."; Euco Epoxy No. 620.
      c. "Silka Chemical Corp."; Sikadure Hi-Mod.

2.11 FORM WORK

A. Provide formwork to conform to shape, lines and dimensions of members indicated on Drawings.

B. Construct formwork sufficiently tight to prevent leakage.

C. Construct formwork for exposed smooth surfaces of plywood or other similar smooth material.

D. Bevel exposed concrete corners 3/4 inch unless otherwise indicated on drawings.

E. Form Coatings:
1. Approved commercial formulation of proven performance that will not bond with concrete surfaces.
2. Shall not impair subsequent treatment and curing of, or otherwise adversely affect, concrete surfaces.
3. Non-staining.
4. Apply before reinforcing steel is placed.

F. Tolerances:
1. ACI 347.

2.12 DRAINAGE FILL / GRANULAR FILL BELOW SLABS-ON-GRADE

A. See Section 31 00 00 – Earthwork.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to placement of any permanent concrete, footings, slabs or other construction, remove all existing surficial fill, topsoil, organic material, wet soil, loose soil, undesirable soils, abandoned concrete and other materials to the extent indicated by the geotechnical engineer.

B. Prior to placing concrete, notify all trades to be certain that all sleeves, conduit, chases, etc. are installed and properly located. . Coordinate all openings and chases required in the concrete work and provide all items to be cast into the concrete pour.

C. Ensure slab subgrade is well drained, of adequate, uniform load bearing nature, and not muddy, soft or frozen.

D. Dampen subgrade ahead of concreting.

E. Test Below-slab pipes prior to casting concrete.

F. Footing excavations shall be drained and firm at time of concrete placement.

G. Vapor Barrier:
1. Shall be properly installed and ready to receive concrete.
2. Damp proof slab on grade with film underlay between fill and concrete.

H. Verify reinforcement and anchors, expansion joint material and embedded items are secured in position. Install anchor rods, dovetail slots and other embedded items as required for support of other work that is attached to or supported by cast-in-place concrete.

I. Joints in Work:
1. Slabs and footings shall have no horizontal joints.
2. Any stop in concrete work shall be made with keyed vertical bulkheads.

3. All reinforcing shall continue through the joint.

J. The Architect or his representative shall be given 24 hours notice to inspect placement of reinforcing steel before concrete is placed.

K. Coordination With Floor Finishes:
1. Contractor is responsible for determining maximum floor moisture levels and ph levels acceptable to floor finish manufacturers and installers.
2. Schedule concrete floor slab pours to allow adequate time for moisture to evaporate prior to installing finish flooring.
3. Provide concrete with a maximum water to cement ratio of 0.50.
4. Allow minimum 3 months curing time before installing floor finish materials.
5. Do not densify surfaces of slabs to receive moisture sensitive floor finishes to the point that the slab cannot dry to the surface.

3.02 VAPOR BARRIER

A. Vapor Barrier:
1. Install the entire system in accordance with ASTM E1643-Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
2. Unroll vapor barrier film over entire area of aggregate or compacted earth base as indicated.
3. Smooth all surfaces and keep clean and free of debris, contamination, tears or damage.
4. Overlap all seams, ends and edges a minimum of 6" in direction of pour.
5. Seal all seams using manufacturer’s sealing tape, sealant or mastic.
6. Seal all penetrations through film using manufacturer’s sealing tape, sealant or mastic, or a combination as required to fully seal around all penetrating items.
7. Correct any damages or tears in film materials and seam systems to protect integrity of system.
8. Provide temporary overlayments as required to protect vapor barrier during slab installation.

3.03 REINFORCEMENT

A. Provide bar supports and spacers in accordance with ACI Detailing Manual.
1. All bar supports in areas where concrete will be exposed shall have plastic feet.
2. Precast concrete blocks, 3"x3"x3", 3000 psi, shall be used to support reinforcing off the ground.
3. At all other locations, chairs or standees shall be used.

B. Detailing, fabrication and placing of reinforcing shall conform to applicable provisions of ACI 315 and ACI 318.

C. Spread bars around small openings and sleeves in slabs and walls where possible and where bar spacing will not exceed 1-1/2 times the normal bar spacing.

D. Discontinue bars at large openings where necessary and provide an area of reinforcement equal to the interrupted reinforcement distributing 1/2 of this reinforcement each side of the opening (Class B tension lap splice).

E. Holes larger than 12 inches in any direction shall have (1) #5 x 5'-0" long diagonal bar in both faces at each corner, whether indicated, detailed or not.

F. Pier reinforcement shall be doweled to the footing.
Provide dowels equal in size, number and grade to the pier reinforcement, unless otherwise indicated.
Dowels shall be hooked 90 degrees at the bottom level of footing reinforcement.
Dowels shall be lapped with the pier reinforcement.

G. Pier reinforcement shall be the same size, number and grade as the column/pilaster reinforcing, unless

otherwise indicated.

H. Reinforcing bars and welded wire fabric or mesh shall be placed and secured prior to pouring concrete.

I. Minimum concrete protection for steel reinforcement:
1. 3/4" for elevated slabs and walls not exposed to earth or weather.
2. 1-1/2" for walls exposed to weather.
3. 3" for footings and other concrete cast against earth.
4. Comply with ACI 318 and 301 requirements for minimum concrete cover for reinforcement.

3.04 CONVEYING AND DEPOSITING

A. Concrete for footings shall be placed the same day excavations are opened.
If this is not possible, steps shall be taken to properly and adequately protect the excavation and maintain its integrity and levels of acceptability.

B. Convey concrete from mixer to form as rapidly as practicable, by methods which will prevent segregation or loss of materials.

C. Vertical drops: maximum three feet free fall.

D. Place concrete as nearly as possible to its final position at a rate so it remains plastic and flows readily into position. Proceed with placing as a continuous operation until unit of construction is complete. Use vertical construction joints to avoid horizontal joints between concrete placements.

E. Do not use retempered concrete or concrete partially hardened or contaminated with foreign material.

F. Ensure forms and conveyance equipment are clean and free of ice, water, debris and hardened concrete.

G. All vertical concrete surfaces shall be formed, including all footings.

H. Provide shear keys in the top of all wall and column footings at concrete walls.

I. Minimum depth for all footings for exterior walls to be 24" below finish grade.

J. No water may be added to any concrete.

3.05 CURING

A. Formwork shall remain in place five (5) days before being removed. Remove all formwork in such a manner and at such time as to not damage concrete surfaces and to ensure complete safety to the structure.

B. Perform curing of concrete of slabs and other horizontal surfaces by moist curing or by use of curing compounds.

C. Moist Curing:
Moist curing shall be performed by application of polyethylene sheeting per ASTM C171 or continuous wetting of burlap or other type of absorptive cover or mat. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4” lap over adjacent absorptive covers. Cure for seven days.

D. Curing Compounds:
1. Apply curing compound immediately following completion of finishing after water sheen has disappeared.

2. Spray or brush uniformly in a single coat immediately after final finishing operation, at rate recommended by manufacturer.
3. Do not use material which discolors concrete or inhibits adherence of other materials.

E. Meet requirements of hot and cold weather concreting.

F. For slabs to receive moisture sensitive floor coverings, cure in accordance with recommendations of ACI 302.2.

G. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

H. Do NOT use membrane curing compounds on surfaces which are to receive coatings applied directly to concrete surfaces (liquid floor hardeners, waterproofing, dampproofing, membrane roofing, flooring, concrete coatings, painting, staining, etc.) unless specifically permitted by the Architect, and written documentation is provided by the coating manufacturer that such compound will not have an adverse effect on adhesion, longevity, durability, performance, or any other issue of the product.

3.06 COLD WEATHER REQUIREMENTS

A. Temperature of concrete when placed shall be not less than 50° F.

B. Temperature of concrete shall be maintained above 50° F and below 90° F for duration of curing period

C. Procedures shall be in accordance with ACI 306. Concrete shall be placed within 90 minutes of batch time.

3.07 HOT WEATHER REQUIREMENTS

A. Temperature of concrete when placed shall be less than 90° F.

B. Concrete shall be placed within 90 minutes of batch time. Shorter time limits may apply when air temperature is in excess of 90° F.

C. Procedures shall be in accordance with ACI 305.

3.08 CONSOLIDATION

A. Consolidate concrete with high-frequency vibrators.

B. Insert vibrators into each 18" lift at intervals not to exceed 12". Insert for sufficient duration to produce complete consolidation without over-vibrating to cause separation.

C. Remove excess free water collecting on the surface during the vibration before finishing.

3.09 JOINTS

A. Locate and construct all joints as shown on the Drawings, or if not shown, as specified herein, or if not specified, as directed by Architect.

B. Construction Joints.
1. May be substituted for control or contraction joints in slabs on grade at the indicated locations of such joints or as approved by the Architect.
2. Provide keyed joints between all cast sections of slabs on grade.

C. Control Joints:
1. Depth: 1/3 thickness of slab or 1” minimum depth, whichever is greater.

2. Width: Maximum 3/16".
3. Spacing:
   a. Slabs:
      1) 4" slab = 12'-0" o.c. maximum.
      2) 5" slab = 13'-0" o.c. maximum.
      3) 6" slab = 14'-0" o.c. maximum.
      4) 8" slab = 17'-0" o.c. maximum.
      5) At greater frequency and other locations as indicated on Drawings.
   b. Walks:
      1) 4'-0" o.c. or the width of the walk whichever is less.
      2) At greater frequency and other locations and patterns as indicated on Drawings.
   c. Walls:
      1) At 20'-0" o.c. each way, maximum.
      2) At greater frequency and other locations as indicated on Drawings.
4. Wet cut joints immediately after concrete set and able to support machine and personnel. Maximum 24 hours after placing.
5. Saw cut joints are not acceptable unless authorized in writing by Architect. If permitted, joints shall be made using the early entry dry-cut method.
6. For control joints scheduled to receive joint fillers, comply with joint filler manufacturer's recommendations for depth and preparation of joint.

D. Expansion Joints: Install 1/2" expansion joint filler at concrete pavement joints; hold down below surface or cut the required depth for sealant.

E. Carry reinforcement across joints in slabs except at expansion joints.

3.10 FINISHING: CONCRETE FINISH SCHEDULE

A. Interior:
   1. Hard trowel smooth finish.

B. Exterior:
   1. Stoops: Hard trowel smooth finish.
   2. Walks: Broom finish. (Hard trowel smooth at expansion and control joints).
   3. Steps: Vertical surfaces rubbed; horizontal surfaces broom finish.

C. Broom finish by drawing broom across surface, transversely after hard troweling (not just floating).

3.11 PROTECTION

A. Protect fresh concrete from heavy rains, extreme air temperatures, injurious sun, mechanical injury and other deleterious elements.

B. If scaling occurs from failure to take protective precautions, repair or replace damaged concrete.

3.12 PATCHING

A. Do not patch any surface until examination is made by the Architect and permission is given.

SUBMITTAL CHECK LIST

1. Concrete Mix Designs.
2. Reinforcement Steel Shop Drawings.
3. Vapor Barrier Product Data.

4. Curing and Sealing Materials Data.

END OF SECTION 03 30 00

SECTION 03 54 00 - SELF-LEVELING CONCRETE FLOOR UNDERLAYMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, material, equipment, special tools, supervision, and services required to prep substrate and properly place self-leveling concrete floor underlayment as indicated on drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Installer's Qualifications: Installation of underlayment shall be by an applicator authorized by the manufacturer using manufacturer’s approved mixing and pumping equipment.

1.03 DELIVERY, STORAGE AND HANDLING

A. General Requirements: Materials shall be delivered in their original, unopened packages, and protected from exposure to the elements. Damaged or deteriorated materials shall be removed from the premises.

1.04 SITE CONDITIONS

A. Environmental Requirements: Before, during and after installation of underlayment, building interior shall be enclosed and maintained at a temperature above 50 degrees F (10 degrees C) and below 100 degrees F (37.7 degrees C) until structure and subfloor temperature are stabilized.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cementitious Self-Leveling Poured Floor Underlayment: Floor underlayment compound to be Level-Right Self-Leveling Floor Underlayment as manufactured by Maxxon Corporation or approved equivalent.

B. Sand Aggregate: Sand shall be silica aggregate meeting requirements of manufacturer.

C. Mix Water: Potable, free from impurities.

D. Subfloor Primer: Underlayment manufacturer’s recommended primer as required.

E. Sealer: Underlayment manufacturer’s recommended sealer as required.

2.02 MIX DESIGNS

A. General Requirements: Underlayment mix proportions and methods shall be in strict accordance with product manufacturer recommendations.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition and Cleaning of Subfloor: Subfloor shall be structurally sound. Contractor shall clean subfloor to remove mud, oil, grease, and other contaminating factors.

B. Leak Prevention: Fill cracks and voids with a quick setting patching or caulking material where leakage of underlayment could occur.

C. Priming Subfloor: Prime concrete subfloor using the manufacturer's recommended primer. Priming instructions vary according to the porosity of the concrete, multiple coats may be necessary.

D. Expansion Joints: Allow joints to continue through the underlayment at the same width.

3.02 APPLICATION OF SELF-LEVELING UNDERLAYMENT

A. Scheduling: Application of underlayment shall not begin until the building is enclosed, including roof, windows, doors, and other fenestration.

B. Application: Place underlayment from 3" (76 mm) to featheredge. Spread and float to a smooth surface. Except at authorized joints, place underlayment as continuously as possible until application is complete so that no slurry is placed against underlayment that has obtained its initial set.

C. Drying: Contractor shall provide continuous ventilation and adequate heat while curing.

3.03 PREPARATION FOR INSTALLATION OF FLOORING

A. Sealing:
   1. Seal all areas according to manufacturer's recommendations.
   2. Verify sealer compatability with flooring adhesives prior to installation.

B. Refer to manufacturer's guidelines for additional information regarding flooring installation.

3.04 FIELD QUALITY CONTROL

A. Slump Test: Underlayment mix shall be tested for slump as it is being pumped using a 2 inch by 4 inch (50 mm by 101 mm) cylinder resulting in a patty size of 9 1/2 inches (241 mm) plus or minus 1 inch (25 mm) diameter.

B. Field Samples: At least one set of 3 molded cube samples shall be taken from each day's pour during the underlayment application. Cubes shall be tested as recommended by the manufacturer in accordance with modified ASTM C 109. Test results shall be available to architect and/or contractor upon request from applicator.

3.05 PROTECTION

A. Protection From Heavy Loads: During construction, place temporary wood planking over underlayment wherever it will be subject to heavy wheeled or concentrated loads.

END OF SECTION 03 54 00

SECTION 04 01 00 - MASONRY PROTECTION AND CLEANING

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish labor, materials, equipment, special tools, supervision and services required to protect masonry materials and masonry work and to complete the cleaning of masonry work.

1.02 DELIVERY, STORAGE AND HANDLING

A. Store masonry and mortar materials in a high, dry location and in such a manner as to prevent absorption of moisture from the ground.
   1. Cover materials completely with waterproof covering securely tied or weighted in place.
   2. Store accessory items to prevent damage from construction operations and elements.

1.03 SUBMITTALS

A. Manufacturer's Literature:
   1. Manufacturer's data sheets, cutsheets and materials description.

PART 2 - PRODUCTS

2.01 CLEANING COMPOUND

A. Provide one of the following approved products (as applicable to specific project conditions):
   1. Brick, Concrete Block, Tile:
      a. "ProSoCo", Sure Klean #600.
      b. "ProSoCo", Sure Klean #101 Lime Solvent (Red and Dark Colored Brick and Surfaces).
      c. "ProSoCo", Sure Klean #800 Stain Remover (Buff or White Brick).
      d. "ProSoCo", Enviro Klean Safety Klean.
      e. "Sonneborn", Sonokleen 88.
      f. “EaCo Chem”, NMD 80.
   2. Pre-Cast Concrete, Poured-In-Place Concrete:
      a. "ProSoCo", Sure Klean #600.
      b. "ProSoCo", Sure Klean Light Duty Concrete Cleaner.
      c. "ProSoCo", Sure Klean Heavy Duty Concrete Cleaner.
      d. "ProSoCo", Enviro Klean Safety Klean.
      e. “EaCo Chem”, NMD 80.

2.02 MATERIALS

A. Use cleaning product especially formulated for cleaning the particular masonry materials involved.
   1. Use only non-staining and non-corrosive products.

PART 3 - EXECUTION

3.01 PROTECTION

A. When masonry work has been stopped for the day, courses shall be leveled and all joints, other than required cavities, shall be well filled with mortar.

B. Protect masonry in place from rain with waterproof coverings securely fastened in place, until roof coverings, copings, flashing, or other permanent protection of the top of walls is in place.

C. Protect all masonry protections from damage by use of wood covers or protective barricades.

3.02 COLD-WEATHER PROTECTION

A. When ambient temperature is below 40°F the temperature of the masonry when laid shall not be less than 40°F.
   1. Thaw frozen sand before use. Do not scorch.
   2. The temperature of the mixed mortar to be at least 70°F but not more than 120°F.
   3. Do not exceed a mixing water temperature of 160°F.
   4. Do not use admixtures or anti-freeze compounds for the purpose of reducing the freezing temperature of mortar.

B. When the ambient temperature is below 20°F, heat masonry units to 40°F. Maintain a temperature of at least 40°F on both sides of the wall for not less than 48 hours.

3.03 HOT WEATHER PROTECTION

A. In hot dry weather, wet the mortar board and cover mortar to retard the drying out of the mortar.

B. When the ambient temperature is above 80°F, mortar which dries too rapidly may be retempered with the addition of small quantities of water. Discard mortar if more than 2 hours after mixing.

3.04 CLEANING

A. After all masonry work is completed, repair and point all defective work to the Architect's approval.
   1. Clean all exposed new work with masonry cleaning products used in accordance with the manufacturer's printed instructions.
   2. Protect all sash and other corrodible materials.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.

END OF SECTION 04 01 00

SECTION 04 05 13 - MORTAR

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to provide and complete all mortar for setting of all masonry work on this Project as indicated, noted, detailed and scheduled on the drawings and specified herein.

1.02 REFERENCES

A. Publications of the following Institutes, Associates, Societies and Agencies are referred to in this section:
   1. American Society for Testing and Materials (ASTM).

1.03 SUBMITTALS

A. Manufacturer's Literature:
   1. Materials description of cement.
   2. Manufacturer's test data for mortar mixtures.

B. Samples:
   1. Manufacturer's actual sample bars of entire selection of standard mortar colors.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver mortar materials, except sand, in full, unopened bags.
   1. Store packaged materials off the ground and keep covered and protected from weather until used.

B. Deliver and stockpile sand in vicinity of the approved batch mixing location.

C. Pre-mixed sand/mortar, silo type batch plants may be used on site.

D. Use pipe or hose to provide clean fresh water at the batch mixing location.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Masonry Cement:
   1. Provide one of the following approved products:
      a. “Essroc”, Brixment.
      b. “Cemex”, Kosmortar.
      c. “Lafarge”, Masonry Cement.
   2. Masonry Cement shall comply with the requirements of ASTM C91.
   3. Portland Cement, Type 1, shall comply with the requirements of ASTM C150.

B. Hydrated Lime:
   1. To comply with the requirements of ASTM C207.

C. Aggregates to Setting Mortar:
   1. Shall comply with the requirements of ASTM C144.
   2. For joints 1/4 inch thick or less, 100% shall pass No. 8 sieve and 95% shall pass No. 16 sieve.

D. Water:
   1. Clean, fresh and potable.

2. Free from injurious amounts of oils, acids, alkalies, organic matter or deleterious substances.

E. Water Repellent:
1. Provide one of the following approved products:
a. "Grace Construction Products"; Dry-Block.
b. “BASF”; Rheopel Plus.
c. “ACM”; RainBloc.
d. “Krete”; HQ.
2. Use for all mortar on exterior concrete masonry walls.

F. Silo Batch Plant:
1. As approved by the Architect.

2.02 MIXES
A. Mortar Mixes:
1. All components to be pre-measured, pre-packaged and pre-mixed by the manufacturer.
2. Ready-mixed mortar, prepared offsite and delivered for storage in tubs, will NOT be acceptable.

B. Type S Mortar:
1. 1,800 psi minimum, high compressive strength tested in accordance with ASTM C270.
2. For use at all exterior masonry walls.
3. For use at all at grade and below grade masonry walls.
4. For use at all interior, reinforced masonry walls.

C. Type N Mortar:
1. 750 psi minimum, medium compressive strength tested in accordance with ASTM C270.
2. For use at all interior, non-reinforced masonry walls.
3. For use at all exterior veneers, brick and stone.

D. No chemical admixtures shall be added to the mortar without the express permission of the Architect.

E. Mortar Color:
1. Tinted, colored mortar.
2. Color as selected by Architect from manufacturer's entire standard selection.
3. Separate mortar colors may be selected for differing materials, or differing colors or textures of the same materials, throughout the project.

PART 3 - EXECUTION

3.01 MIXING
A. Mix mortar mix and water proportions by volume per manufacturer's requirements.

B. Mix mortar in an approved drum type batch mixer to a uniform color, texture and consistency.
1. Measure ingredients carefully and completely empty drum between batches.
2. Hand mixing will not be permitted.

C. Add water repellent to mortar per manufacturer's instruction.

3.02 CONSISTENCY
A. Mortar shall be consistent to the satisfaction of the mason and may be re-tempered on the boards by

adding small amounts of water and remixing if stiff due to evaporation.

B. Do not use mortar that has become stiff due to hydration or that has been mixed more than two hours.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Color samples.

END OF SECTION 04 05 13

SECTION 04 05 19 - MASONRY REINFORCEMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to furnish and install all masonry reinforcement indicated, noted and detailed on the Drawings and specified herein.

1.02 REFERENCES

A. Publications of the American Society for Testing and Materials, ASTM are referred to in this section.

B. All work shall comply with ACI 530 and recommendations of The Masonry Society.

1.03 DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries to provide sufficient quantities of reinforcement to permit continuity of masonry work.

B. Store reinforcement on blocks or shores to prevent contact with the ground and keep covered to prevent damage from the weather.

1.04 SUBMITTALS

A. Manufacturer's Literature:
   1. Manufacturer's data sheets, cutsheets and materials description.
   2. Test data for strength and integrity.

B. Samples:
   1. Provide actual sample of unit as requested by the Architect.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following acceptable manufacturers:
   1. Hohmann & Barnard (H&B).
   2. A-A Wire Products Company.
   3. Baltimore Birmingham.
   4. Wire-Bond
   5. Heckman Building Products, Inc.
   6. Masonry Reinforcing Corp. of America.
   7. National Wire Products Corp.

2.02 MATERIALS

A. Materials shall conform to the following requirements:
   1. American Society for Testing and Materials (ASTM).
   2. "Cold-Drawn Steel Wire for Concrete Reinforcement", ASTM Designation A82.
   3. Mill galvanized wire in accordance with ASTM A641, Class 3 (0.80 oz./ft.2).

B. Provide deformed bars of the size indicated on the drawings of the following grades:
   1. All reinforcing: ASTM A615, Grade 60.

C. Provide all required metal accessories, including spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing and supporting all reinforcement in place.

2.03 HORIZONTAL JOINT REINFORCEMENT

A. Description:
1. Hot dipped galvanized.
2. Prefabricated from cold-drawn steel wire complying with ASTM A82.
3. Welded wire units comprised of two No. 9 gauge deformed continuous longitudinal side rods and a continuous No. 9 gauge plain cross rods at 16" o.c. maximum, spanning between to form a truss design.
4. Factory prefabricated Corners and Tees shall be used at all corners and intersecting walls and shall be of the same design, gauge, profile and finish as the continuous joint reinforcement.

B. Size:
1. Furnish in standard length sections, not less than 10'-0".
2. Width to be 2 inches less than width of the wall.

C. Provide one of the following approved products for single-wythe systems:
1. "H&B", #120, Lox-All Truss Mesh.

2.04 CAVITY WALL REINFORCEMENT

A. Description:
1. Brick and Block Veneer: Hot dipped galvanized.
Stone Veneer: Stainless steel, type 304.
2. Prefabricated from cold-drawn steel wire complying with ASTM A82.
3. 2-piece design comprised of a continuous joint reinforcement member, of a truss or ladder design, and a veneer wall tie that interlock together via an integral eye wire hook and loop.
4. Factory prefabricated Corners and Tees shall be used at all corners and intersecting walls and shall be of the same design, gauge, profile and finish as the continuous joint reinforcement.

B. Continuous Joint Reinforcement Member:
1. Wire units comprised of two No. 9 gauge deformed continuous longitudinal side rods and a continuous No. 9 gauge plain cross rods at 16" o.c. maximum, spanning between to form a truss or ladder design.
2. Integral projecting eyes factory welded to the continuous joint reinforcement.
Length of projecting arms for eyes to be as required for thickness of wall cavity construction.

C. Veneer Wall Ties:
1. U-shaped ties with hooked open ends to interlock into eyes on continuous joint reinforcement member.

D. Provide one of the following approved products:
1. "H&B", Lox-All, Adjustable Eye Wire, Truss Type #170, with adjustable ties.
2. "H&B", Lox-All, Adjustable Eye Wire, Ladder Type #270, with adjustable ties.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout.

B. Position reinforcement accurately at the spacing shown. Support and secure vertical bars against displacement. Provide a clear distance between bars of not less than the nominal bar diameter or 1 inch, whichever is greater.

C. Provide continuous horizontal joint reinforcement in all reinforced masonry walls at 16 inches o.c.

D. For pilasters, provide a clear distance between vertical bars as shown, but not less than 1-1/2 times the nominal bar diameter or 1-1/2 inches, whichever is greater. Provide lateral ties as shown.

E. A continuous bond beam with (2) #5 bars shall be provided at the top of all walls, and at all bearing elevations, unless otherwise indicated.

F. At beams or lintels bearing on masonry walls, fill (2) block cores solid with grout and reinforce each core with one vertical #5 bar full height of wall, unless otherwise indicated.

G. Place (1) full height vertical #5 bar at all wall corners, ends of walls, sides of openings and wall intersections, unless otherwise indicated. Place (2) vertical #5 bars at sides of openings 10'-0" wide and greater, unless otherwise indicated.

3.02 SPLICES

A. Splice reinforcing bars where shown. Do not splice at other points unless approved by the Architect/Engineer.

B. Splices shall be lapped, unless otherwise indicated.

C. In splicing vertical bars or attaching to dowels, lap ends and place bars in contact and tie with wire.

D. Splices in vertical reinforcement shall be lapped a minimum of 48 bar diameters, unless noted otherwise.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Samples.

END OF SECTION 04 05 19

SECTION 04 05 23 - MASONRY ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. All labor, materials, equipment, special tools, supervision, and services required to provide and complete all masonry accessories for all masonry work on this Project as indicated, noted, detailed, and scheduled on the Drawings or specified herein.

1.02 DELIVERY, STORAGE AND HANDLING

A. Storage: Store steel accessories off of the ground, on blocking, with waterproof cover.

1.03 QUALITY ASSURANCE

A. All work shall comply with ACI-530 and recommendations of The Masonry Society.

B. Hot dipped galvanizing after fabrication per ASTM A153 (1.5 oz./ft.).

1.04 SUBMITTALS

A. Manufacturer's Literature:
   1. Manufacturer's data sheets, cutsheets and materials description.

B. Samples:
   1. Provide actual sample of unit as requested by the Architect.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following acceptable manufacturers:
   1. Hohmann & Barnard (H&B).
   2. Masonry Technology Inc. (MTI).
   3. Advanced Building Products.
   4. Sandell Manufacturing.
   5. A-A Wire Products Company.
   6. Baltimore Birmingham.
   7. DUR-O-WALL, Inc.
   8. Heckman Building Products, Inc.
   9. Masonry Reinforcing Corp. of America.
   10. National Wire Products Corp.

2.02 MATERIALS

A. Weep Holes:
   1. Provide one of the following approved products:
      a. "H&B", #QV-Quadro Vent.
      b. "MTI", Cavity Vent.
      c. "Advanced Building Products", Mortar Maze.
      d. "Sandell Manufacturing", Mortar Net Weep Vents.

B. Control Joints:
   1. Provide one of the following approved products:
      a. "H&B", RS Series.
      b. “BoMetals, Inc.”, BCJ Series.
   2. Preformed elastomeric rubber, with shear keys and flanges.

C. Veneer Wall Ties:
1. At veneer cavity walls with concrete masonry back-up:
a. See Specification 04 05 19 - Masonry Reinforcement.

D. Mortar/Grout Screen:
1. Provide one of the following approved products:
a. "H&B", #MGS.
2. 1/4" square microfiliment screen.
3. Polypropylene polymer, non-corrosive.

E. Rebar Positioners:
1. Provide one of the following approved products:
a. "H&B", #RB and #RB-Twin.
2. Z-shaped wire bridge.
3. 9 gauge wire.
4. Size for block width and core dimension as required.
5. Hot dipped galvanized.

F. Masonry Slip Joint:
1. Provide one of the following approved products:
a. "H&B", #NS.
2. Placed in masonry coursing below relieving angle.
3. Closed cell neoprene sponge.
4. 3/8" thickness to match mortar joint coursing x width of entire masonry unit.
5. Adhesive backing, one side only.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Weep Holes:
1. Install in strict accordance with the manufacturer's published recommendations.
2. Provide in head joints in first course immediately above all flashing, at spacing as indicated on the drawings. If not indicated, provide at 32” o.c.
3. Keep area above flashing free of mortar droppings.

B. Control Joints:
1. Install in strict accordance with the manufacturer's published recommendations.
2. Provide control joints at all inside corners and where new masonry abuts existing masonry.
3. Lap horizontal joint reinforcing at all control joints.
4. Locate vertical control joints at 16'-0" o.c. maximum for all masonry.
5. Locate elsewhere where indicated on the Drawings.

C. Ties and Anchors:
1. Install in strict accordance with the manufacturer's published recommendations.
2. Install ties into projecting eyes of truss or ladder type wall reinforcement, or into retainer area of supportive stud clip or anchor device.
3. Position for proper placement in veneer wall.

D. Rebar Positioners:
   1. Install in strict accordance with the manufacturer's published recommendations.
   2. Secure all vertical reinforcing bars in all masonry walls by use of positioners.
   3. Position re-bar in center of concrete block core.
   4. Rest bends of wire on shell of block to allow wire to span and bridge cell.

E. Masonry Slip Joint:
   1. Install in strict accordance with the manufacturer's published recommendations.
   2. Place at horizontal mortar joint coursing located just below the steel relieving angle in both the veneer and the masonry back-up wall.
   3. Install with adhesive backing, bottom side only. Top side shall be free to "float" below course above.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Samples.

END OF SECTION 04 05 23

SECTION 04 05 23.16 – MASONRY EMBEDDED FLASHING

PART 1 - GENERAL

1.01 DESCRIPTION
A. Flexible flashing as shown for drawings and specified herein. Including, but not limited to thru-wall flashing and other flashing for masonry work.

1.02 SUBMITTALS
A. Submit manufacturer's data sheets for each product used.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS AND TYPES
A. Provide one of the following or an approved equivalent:
1. York Manufacturing “Multi-Flash 500”.
2. STS Coatings “Wall Guardian Copper TWF”
3. Wire-Bond “Copper Seal”

2.02 MATERIAL
A. Characteristics:
1. Type: Copper core with polymer fabric laminated to copper face on both sides with non-asphalt adhesive.
2. Copper core: ASTM B370, CDA Alloy 110
3. Weight: 3 oz. per square foot.
4. Fabric: Polymer fabric; laminated both faces of copper core
5. Size: Manufacturer’s standard width rolls

PART 3 - EXECUTION

3.01 INSTALLATION
A. Whether shown on Drawings or not, install flashing at the following locations:
1. Install at heads and sills of all openings in walls, base courses, sill courses, angles and wall penetrations.
2. Install thru-wall flashing at top course of all brick walls at retaining walls, planter walls, walls at site stairs and ramps, and all other similar conditions.

B. Extend flashing 6" beyond opening or joint.

C. Build in flashing with mortar as masonry work progresses.

SUBMITTAL CHECK LIST
1. Manufacturer's material data sheet.

END OF SECTION 04 05 23.16

SECTION 04 21 13 - FACE BRICK MASONRY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete brick masonry work.

1.02 QUALITY ASSURANCE

A. Qualifications:
   1. Employ masons skilled and experienced in the setting of brick.
   2. Only first-class brickwork will be accepted.

B. Mock-Up Panel:
   1. Construct on site sample panel 4 foot wide x 4 foot high, of typical wall thickness and construction.
   2. Show proposed color range, texture, bond, mortar color, mortar joint and workmanship of masonry materials.
   3. Do not proceed with masonry work until sample panel has been approved.
   4. Use panel as standard of comparison for all masonry work.
   5. Do not destroy or remove panel until all masonry work is complete and accepted.

1.03 SUBMITTALS

A. Samples:
   1. If specific brick has been specified:
      Masonry contractor to submit brick panels or 5-brick pallet samples for final approval by Architect. Color, texture and range of brick to be submitted as specified.
   2. If specific brick has not been specified:
      Masonry contractor to select and submit brick panels or 5-brick pallet samples for final selection by Architect. Color, texture and range of brick to be submitted to be per direction of the Architect.
   3. Brick submitted shall conform to these specifications and be within color and texture range specified.
   4. Selected brick samples shall have mock-up panels constructed for final selection and approval.
   5. Lay additional sample panels as directed by Architect
   6. Architect reserves the right to select any brick from any supplier.

B. Test reports indicating compressive strength, water absorption, saturation and suction.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store brick off ground to prevent contamination by mud, dust or materials likely to cause staining or other defects.

B. Cover materials as necessary to protect from elements.

PART 2 - PRODUCTS

2.01 FACE BRICK

A. Description:
   1. Size:
      a. Utility size units: 11-5/8 inches long x 3-5/8 inches high x not less than 3-5/8 inches deep.
   2. Color and Texture:
      a. Match existing building.

B. Special Shapes:
   1. Cut standard unit with power saw or provide units manufactured to sizes or shape required.
   2. Provide solid brick, watertable profile, finished ends, special sizes, etc. as required.
   3. Special shape items to match selected brick in every other respect.

C. Conform to ASTM C 216, Grade SW, Type FBS.

D. Brick submitted shall be from brick manufacturers who are able to provide certification and physical evidence that the brick has been successfully used in projects of similar exposure for at least three complete climatic cycles without physical or visual changes.

E. Do not exceed variations in color and texture of accepted samples and mock-up.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify initial absorption rate of brick is within acceptable limits.

B. Reduce initial absorption exceeding 20 g./30sq. in/min by thoroughly wetting with clean water 24 hours prior to placement.

3.02 INSTALLATION

A. General:
   1. Lay brick plumb and true to lines.
   2. Cut exposed brick with masonry saw.
   3. Anchor brick veneer to backing with metal reinforcement.
   4. Where fresh masonry joins partially set masonry.
      a. Remove loose brick and mortar.
      b. Clean and lightly wet exposed surface of set masonry.
   5. Stop off horizontal run of masonry by racking back 1/2 length of unit in each course.
   6. Toothing is not permitted except upon written acceptance of the Architect.

B. Weep Holes:
   1. See Section 04 05 23 - Masonry Accessories.
   2. Keep weep holes and area above flashing free of mortar droppings.

C. Sealant Recesses:
   1. Retain joints around outside perimeters of exterior doors, windows frames and other wall openings.
   2. Depth: Uniform 3/4 inch.
   3. Width: 3/8 inch.

D. Movement Joints:
   1. Keep clean from all mortar and debris.
   2. Locate as shown on drawings.

E. Sealant:
   1. See Section 07 92 00-Joint Sealers for all labor and material for sealing perimeter recesses and joints.

3.03 PROJECT CONDITIONS

A. Staining: Prevent grout or mortar from staining the face of masonry to be left exposed or painted.
   1. Remove immediately grout or mortar in contact with face of masonry.
   2. Protect sills, ledges and projections from mortar droppings.
   3. Protect door jambs and corners from damages during construction.

B. Cold Weather Protection:
   1. Preparation:
      a. If ice or snow has formed on masonry bed, remove by carefully applying heat until top surface is dry to the touch.
      b. Remove all masonry deemed frozen or damaged.
   2. Products:
      a. When brick suction exceeds 20 g/30 sq. in./min., sprinkle with heated water.
         1) When units are above 32°F, heat water above 70°F.
         2) When units are below 32°F, heat water above 130°F.
      b. Use dry masonry units.
      c. Do not use wet or frozen units.

SUBMITTAL CHECK LIST

1. Brick Samples.
2. Test Reports.
3. Mock-up Panel.

END OF SECTION 04 21 13

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to provide and complete all concrete unit masonry work on this Project as indicated, noted, detailed and scheduled on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Comply with the provisions of the latest editions of the following Codes, Specification and Standards, except as otherwise indicated on the Drawings or specified herein.
   1. The Masonry Society, Masonry Designer's Guide.
   2. ACI 530 Building Code Requirements for Masonry Structures.
   3. ACI 530.1 Specifications for Masonry Structure.
   4. NCMA "Specification for the Design and Construction of Load-Bearing Concrete Masonry".
   5. "American Standard Building Code Requirements for Masonry, A41.1-1953 (R1970)".
   6. American Society for Testing and Materials (ASTM).

B. Concrete masonry units used throughout the work shall be obtained from one manufacturer.

C. Reinforced hollow load-bearing CMU shall be Grade N-I moisture controlled units conforming to ASTM C90-85. Minimum Compressive Strength required for units shall be 2,000 psi on the NET AREA of the units and 1,000 psi on the GROSS AREA. Normal weight or light weight units.

D. Provide special shapes where required, for lintels, bond beams, pilasters, headers and other special conditions.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's catalog data, cutsheets, literature, specifications and installation instructions.
   2. Test data for unit strength.

B. Color Samples:
   1. If color is indicated, submit actual sample of finish selected for final review and approval.
   2. If not indicated, color to be selected by Architect from manufacturer's entire selection.
   3. Submit actual samples for review and approval if requested.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS (CMU)

A. Size:
   1. Standard-sized units shall be used, unless otherwise noted.
   2. Nominal face dimensions of 16 inches long x 8 inches high.
   3. Thickness of units shall be as indicated on drawings.
   4. See drawings for additional requirements or clarifications for type, face, texture, finish, color, etc.

B. Properties:
   1. Below Grade: Standard/Normal weight units with sand, gravel, crushed stone, aggregate.
   2. Above Grade: Light weight units with expanded aggregate.
   3. Shall comply with the requirements of ASTM C90.

C. Water Repellent:
   1. Provide one of the following approved products:
      a. "Grace Construction Products"; Dry-Block.
      b. “BASF”; Rheopel Plus.
      c. “ACM”; RainBloc.
      d. “Krete”; HQ.
   2. Use for all exterior walls whose concrete masonry face is exposed to the exterior. Not required for masonry backup in veneer walls (brick, stone, etc.).

D. Reinforced Load-Bearing CMU and CMU Shear Walls:
   1. Grade N-1 moisture controlled units.
   2. Minimum compressive strength of 2,000 psi on the NET AREA of the units. Minimum compressive strength of 1,000 psi on the GROSS AREA of the units. Standard/Normal weight or Light weight units.
   3. Shall comply with the requirements of ASTM C90-85.
   4. Net compressive strength: f’m = 1,500 p.s.i minimum (Prism or Unit Strength Method).

E. Color:
   1. Standard natural, non-colored concrete masonry unit.

F. Provide one of the following approved products:
   1. “4D/Schuster’s (Oldcastle)”; Custom Architectural Masonry Units.
   2. “General Shale”; Custom Architectural Masonry Units.
   3. “Lee Building Products”; Custom Architectural Masonry Units.
   4. “Masolite”; Concrete Masonry Units.

2.02 SPECIAL UNITS

A. Provide special shapes where required throughout the work for lintels, bond beams, bullnoses, pilasters, headers and other special conditions.

B. Same material, surface, texture, aggregate, grade and color of adjacent concrete masonry units.

C. Brick units for bearing, leveling and filling.

D. Bullnose units with 1 inch radius corner.

E. U-block and bond beam units.

F. Center-scored units with 3/8 inch vertical groove to form an 8 inch x 8 inch face pattern. Scoring pattern may be required to be on both faces of masonry unit.

2.03 PRE-CAST CONCRETE LINTELS

A. Design and strength as approved by the Architect.

B. Same material, surface, texture and color of adjacent concrete masonry units.

C. Score with vertical joints to match block pattern, if desired by the Architect.

2.04 MORTAR

A. See Specification Section 04 05 13 - Mortar.

2.05 STEEL REINFORCEMENT

A. See Specification Section 04 05 19 - Masonry Reinforcement.

2.06 GROUT

A. Grout for reinforced masonry shall have a minimum compressive strength of 2,500 psi at 28 days and shall comply with requirements of ASTM C150.

B. Portland Cement, Type 1, and shall comply with the requirements of ASTM C150.

C. Fine aggregates for grout shall comply with the requirements of ASTM C404.

D. Coarse aggregates for grout shall be pea gravel, 3/8" diameter maximum.

E. Water shall be clean, fresh and potable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Bond:
   1. Running bond on all exposed walls, unless otherwise indicated.

B. Tooling:
   1. Smooth concave joints for all areas, except center scored block.
   2. Raked joint for center scored block.

C. Placing:
   1. Set units plumb and true to line with level, accurately spaced and coordinated with other work.
   2. Lay CMU units with full-face shell mortar beds.
   3. Fill vertical head joints solidly with mortar from face of unit to a distance behind face equal to not less than the thickness of the longitudinal face shells.
   4. Solidly bed cross-webs of starting courses in mortar.
   5. Provide 3/8 inch joints unless otherwise shown.

D. Bond Beams:
   1. Use special units or modify regular units to allow for placement of continuous horizontal reinforcing bars as indicated.
   2. Place wire screening or expanded metal lath in mortar joints under bond beam courses over non-reinforced vertical cores, or provide units with solid bottoms.

E. Pilasters:
   1. Lay wall and pilaster units together to maximum pour height shown.
   2. Pilaster units shall provide minimum clearances and grout coverage for number and size of vertical reinforcement as indicated.

F. Bullnose Units:
   1. Install at all exposed vertical corners, unless otherwise indicated.
   2. Install at all exposed horizontal edges, unless otherwise indicated.

G. Square Edge Units:
   1. Use only where specifically noted as allowed in lieu of bullnose edges.
   2. All exposed square edge block units must be formed using a Universal Press Top (UPT) mold.

H. Build masonry construction to the full thickness shown, except build single-wythe walls to the actual thickness of the masonry units, using unit of nominal thickness as indicated or specified.

I. Cut masonry units with motor-driven saw designed to cut masonry, with clean, sharp, unchipped edges. Use full units without cutting wherever possible. Use dry cutting saws to cut concrete masonry units.

J. Maintain vertical continuity of core or cell cavities which are to be reinforced or grouted, to provide minimum clearance and grout coverage for vertical reinforcing bars. Solidly bed webs in mortar where adjacent to reinforced cores.

K. DO NOT WET concrete masonry units.

L. Use no piece shorter than 8 inches.

M. Bond all corners in each course.

N. All masonry walls shall be laterally braced by the Contractor as required until all structural framing and decking have been installed in units of construction adjacent to the walls.

O. As the work progresses, install all built-in items as specified under this or any other Section.

3.02 GROUTING

A. Contractor may use either low-lift or high-lift grouting techniques, subject to the following requirements.

B. All masonry units located below grade shall be grouted solid, whether indicated or not.

C. Low Lift Grouting:
   1. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical fall measuring not less than 2 inches by 3 inches.
   2. Units must be laid to a height not to exceed 8 feet. If height exceeds 4 feet, cleanouts must be used. Stop pour at course below bond beams.
   3. Place vertical steel into cells with enough steel extending to provide lap splice of 48 bar diameters or as indicated on drawings.
   4. In grouting vertical cells, stop grout 1-1/2 inches below top of unit or over horizontal steel which shall be fully embedded in grout.
   5. Place grout continuously, using a chute or container with spout. Rod or vibrate grout during placing. Do not interrupt placing of grout for more than 1 hour.
   6. Place horizontal bond beam reinforcement as the masonry units are laid. Lap at corners and intersections. Place grout in bond beams before filling vertical cores above bond beams.
   7. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Reinforce or brace cleanouts to resist grout pressure.
   8. Prior to grouting, inspect and clean grout spaces. Clean top surfaces of all structural members supporting masonry to ensure bond.

D. High-Lift Grouting:
   1. All paragraphs and items for Low-Lift Grouting above apply to this section, with the exception of the limitation of height that units must be laid to.

2. Limit grout pours to sections which can be completed in one working day with not more than one hour interruption of pouring operation. Place grout in lifts which do not exceed 4 feet. Allow not less than 30 minutes nor more than one hour between lifts of a given pour. Rod or vibrate each grout lift during pouring operation.
3. Place grout by pumping into grout spaces. Alternate placing methods shall be approved by the Architect/Engineer.
4. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 6 feet.
5. Minimum cell dimension shall be 3 inches for high-lift grouting.

3.03 FORMWORK AND SHORES

A. Provide temporary formwork and shores as required for temporary support of reinforced masonry elements. Design, erect, support, brace and maintain formwork properly.

B. Construct formwork to conform to shape, line and dimensions as shown.

C. Forms and/or shores shall not be removed until reinforced masonry member has hardened sufficiently to carry its own weight and all other loads that may be placed on it during construction.

D. Provide bracing adequate to resist wind loads, bracing shall remain in place until metal roof deck installation and attachment to masonry walls is completed.

3.04 REPAIR, POINTING AND CLEANING

A. By brushing, stoning, rubbing, detergent and water, or other approved method.

B. Remove and replace masonry units that are loose, chipped, broken or otherwise damaged. Provide new units to match adjoining and adjacent units, and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

C. During the tooling of joints, enlarge any voids or holes and completely fill with mortar. Point-up all joints to provide a neat, uniform appearance.

D. Clean exposed CMU masonry by dry brushing at the end of each day's work and after final pointing to remove mortar spots and droppings. Comply with recommendations in NCMA TEK Bulletin No. 28.

SUBMITTAL CHECKLIST

1. Product Data.
2. Color Samples.

END OF SECTION 04 22 00

SECTION 05 10 00 - STRUCTURAL STEEL

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to fabricate, deliver and erect all structural steel indicated, noted and detailed on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A. All shop and field welders must hold a current and valid certificate issued by the American Welding Society. Certificates shall be carried and presented upon request of Architect/Engineer.

1.03 REFERENCE

A. Publications of the following institutes, associations, societies and agencies are referred to in this Section.
   1. American Society for Testing & Materials, ASTM.
   2. American Institute of Steel Construction, AISC.
   3. Steel Structures Painting Council, SSPC.
   4. American Welding Society, AWS.

B. Comply with the applicable portions of the following publications.
   1. “Manual of Steel Construction”, AISC.
   2. “Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings”, AISC.
   3. “Structural Steel Detailing”, AISC.
   4. “Specifications for A-36 and A-50 Steel Arc Welding Electrodes”, AWS.
   5. “Code for Arc Welding in Building Construction”, AWS.
   6. “Steel Structures Painting Manual”, SSPC Vol. 2.
   7. “Riveted and Bolted Structural Joints”, AISC.
   8. “Specifications for Structural Joints Using ASTM A325 and A490 Bolts”, AISC.

C. All structural steel and accessories shall be domestic products. Imported products will not be approved or used.

1.05 SUBMITTALS

A. Furnish to the Architect/Engineer for his approval complete shop and field erection drawings.
   1. Submit drawings prior to fabrication and erection of structural steel.
   2. Base drawings on AISC Publication “Structural Steel Detailing”.
   3. All connections not sized on drawings to be designed by licensed professional engineer, and certified designs to be indicated on shop drawings.
   4. Include complete details and schedules for the fabrication of each member.
   5. Include complete details, schedules, procedures and diagrams showing sequence of erection.
   6. Each member shown on the shop drawings shall be marked in such a manner that the member designations on the drawings coincide with the member designations on the member in the field.
   7. Complete anchor bolt setting plan for use in setting anchor bolts and leveling plates.

B. Furnish the Architect/Engineer with the following certificates.
   1. AWS Certification of all welders who will perform work on this project.
   2. Certification form supplier that structural steel furnished for this project conforms to this specification.

1.06 DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries in quantities to permit continuity of installation.

B. Store on blocks off ground and cover to prevent rusting, denting and damage to materials or structure.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural Steel:
   1. ASTM Specification A36 (36 KSI) except as follows:
      a. Tubular Steel:
         1. ASTM Specification A500 Grade B (46 KSI) (Cold Formed) or A501 (Hot Formed)
      b. Steel Pipe:
         1. ASTM Specification A500 Grade B, (42 KSI).
      c. Wide Flange Shapes:
         1. ASTM Specification A992 (50 KSI).

B. Paint For Shop Application:
   1. Prime with Type 1, oil alkyd, red oxide to minimum 2 mil dry thickness.

C. High-Strength Bolts, Including Nuts and Washers:
   1. ASTM Specification A325.
   2. Heavy hexagon structural bolts, heavy hexagon nuts and washers as required, unless otherwise indicated.
   3. Washers for high strength bolts shall be flat circular hardened steel washers conforming to ASTM F436.

D. Welded Headed Studs Used As Concrete Anchors:
   1. Shall be 1/2” diameter x 4” A.W.L., unless otherwise noted.
   2. Low carbon steel solid fluxed studs complying with ASTM A-108 with a minimum Fu = 60 KSI.
   3. Shall be automatically end welded.

E. Bolts and Nuts, Other Than High-Strength:
   1. ASTM Specification A307, Grade A.

F. Plain Washers, Other Than Those In Contact With High-Strength Bolt Heads and Nuts):
   1. ASNI Standard B18.22.1, Type B.

G. Anchor Bolts:
   1. Comply with ASTM F1554 Grade 36.
   2. Non-headed type with heavy hexagon structural nuts and washers as required, unless otherwise indicated.

H. Electrodes for Welding:
   1. Comply with AWS Code, using ASTM A233 E-70 series covered mild steel electrodes.

I. Non-Shrink Grout:
   1. Design is based on use of "Embeco" high-strength non-shrink grout manufactured by Master Builders.
   2. Non-Shrink grout shall be that upon which design is based or an equal approved by the Architect.

J. Remove all rolling and mill identification marks on all exposed members.

2.02 FABRICATION

A. Rolled steel to shapes indicated with straight lines, sharp angles and smooth curves. Finished members to be true to line and free from twists, bends and open joints. Properly mark and match-mark all materials for field assembly.

B. Fitting:
   1. Bearing surfaces: Planed to true beds.
   2. Abutting surfaces: Closely fitted.

C. Use standard AISC framed connections using ASTM A325 bolts for attaching beams to columns except as otherwise shown. Develop design capacity of beam if not otherwise specified.\

D. Holes for turned bolts: 1/6 in. larger than external diameter of bolt.

E. Weld all shop connections except where otherwise shown or specified. Grind smooth all welds exposed in finished areas.

2.03 SHOP PAINTING

A. Clean structural steel of rust, scale, oil, grease or other foreign matter in accordance with SSPC Specifications SP3.

B. After cleaning apply one shop coat of primer.
   1. Apply shop coat of Type 1, oil alkyd, red oxide to minimum 2 mil dry film thickness
   2. Field touch-up all damaged paint areas using primer paint furnished by the fabricator. Touch-up includes bolts.

C. All exterior structural steel exposed to weather shall be hot dipped galvanized.
   1. Hot dip galvanize per ASTM A123, minimum 2.0 ounces per square foot.
   2. Touch-up primer: SSPC 20, Type III inorganic zinc rich, 95% weight of dry film.

2.04 COOPERATION

A. Provide holes and connections required for other branches of the work where indicated. Secure from other trades associated on the project all necessary drawings and/or templates showing exact location and details required.

B. Coordinate elevations with joint supplier.

PART 3 - EXECUTION

3.01 FIELD MEASUREMENT & COORDINATION

A. The contractor is responsible for obtaining all necessary field measurements at the job site and will be held responsible for their accuracy and for the accurate fitting of this work with the work of others.

B. Coordinate the installation of all holes, slots, anchoring assemblies and other necessary devices required by other sections of this specification. Do not install or attach such material which is acknowledge by AISC, ASTM, SSPC, AWS or manufacturer=s literature to be detrimental to the strength and durability of the structural steel. Do not make any such installations without prior review by the Architect/Engineer. Cutting, burning, drilling or punching of the steel in the field will not be permitted unless approved by the Architect/Engineer.

3.02 ERECTION

A. Accurately set structural steel in accordance with approve shop and erection drawings to the lines and elevations indicated or noted with a maximum tolerance of 0.002 foot for 1/500.

B. Grout under base plates and at other connections as shown on the Contract Drawings using non-shrink grout as specified herein. Grout under column base plates and secure hold down nuts before any other members are connected to columns. Provide leveling plates, double nuts shall not be used for leveling.

C. Install anchor bolts and other connectors required for securing structural steel to foundations and other in-place work.

3.03 CONNECTIONS

A. Bolts in connections not within the slip-critical category shall be tightened to the snug tight condition, as defined in paragraph 8 (c) of the "Specification for Structural Joints Using ASTM A325 or A490 bolts".

B. Bolts in connections within the slip-critical category shall be tightened using the turn-of-nut method, as defined in paragraph 8 (d) (1) of the "Specification for Structural Joints Using ASTM A325 or A490 bolts".

C. All shop connections for beams and minor parts shall be welded.

D. All field connections for beams and minor parts shall be bolted, where possible. Short slotted holes in beam web shall be detailed for beam connections where possible.

E. Details shown on the plans are to illustrate general methods of connection and do not necessarily include all pieces required to complete the work. Such pieces are to be furnished as specified and/or required to complete the work.

F. Connections not shown on the drawings shall be designed by the steel supplier in accordance with the AISC "Manual of Steel Construction". Simple span connections for beams shall be designed for one-half the beam load capacity as given in the AISC "Uniform Load constants for Beams Laterally Supported" Tables.

G. Length of connection angles or plates for beam-to-column connections shall be the largest standard length less than or equal to the "T" dimension of the beam. Standard lengths of connection angles are found in "A.I.S.C. Manual of Steel Construction, Framed Beam Connections, Table II".

H. All connections not shown on the drawings shall be designed by a Structural Engineer registered in the state where the structural steel is to be erected, retained by the steel fabricator. All calculations and shop drawings shall be duly stamped by the Registered Structural Engineer and submitted for review by the Structural Engineer. Stamping of shop drawings shall be for the exclusive purpose of certifying that the connections are detailed as per the design performed by the Registered Structural Engineer. Failure to submit stamped shop drawings and stamped calculations shall be sufficient cause for rejection of shop drawings. The Contractor shall be liable for the dimension, fit, tolerances, fabrication and erection.

I. Welds shall be made only by operators who are qualified as prescribed in the "Standard Qualifications Procedure" of the American Welding Society. The Contractor shall furnish the Engineer with documents establishing the qualifications of welders involved in the work.

J. Holes for the connection of all structural steel work, including slotted holes, shall be punched or drilled in the shop. Any additional holes not shown on the shop drawings shall be approved by the Engineer

and shall be drilled in the field.

K. All welds shall be pre-qualified in accordance with AWS D1.1.

L. After erection and inspection, welded and bolted connections and abraded areas shall be thoroughly cleaned and covered with "Shop Coat" paint applied by this contractor.

3.04 FLAME CUTTING

A. There shall be no flame cutting in the field without the approval of the Architect. If cutting is approved, cut members shall be finished in a manner and to an appearance acceptable to the Architect.

3.05 WELDING INSPECTION

A. The Inspector(s) shall be an AWS Certified Welding Inspector (CWI) qualified and certified in accordance with the provisions of AWS QC1, Standard for Qualification and Certification of Welding Inspectors.

B. The Inspector shall ascertain that all fabrication and erection by welding is performed in accordance with the requirements of the contract documents.

C. The Inspector shall make certain that all welding procedures are pre-qualified.

D. The Inspector shall inspect the welding equipment to be used for the work to make certain that it conforms to the requirements of AWS D1.1.

E. The Inspector shall require re-qualification of any welder or welding operator who has for a period exceeding six months not used the process for which the welder or welding operator was qualified.

F. The Inspector shall make certain that the size, length, and location of all welds conform to the detail drawings and that no unspecified welds have been added without approval.

G. The Inspector shall make certain that only welding procedures are employed which meet the provisions of AWS D1.1.

H. The Inspector shall make certain that electrodes are used only in the positions and with the type of welding current and polarity for which they are classified.

I. The Inspector shall, at suitable intervals, observe joint preparation, assembly practice, the welding techniques, and performance of each welder, welding operator, and tacker to make certain that the applicable requirements of AWS D1.1 are met.

J. Inspectors shall identify with a distinguishing mark or other recording methods all parts of joints that they have inspected and accepted.

K. The Inspector shall keep a record of qualifications of all welders, welding operators, and tackers, and all procedure qualifications or other tests that are made and such other information as may be required.

L. The contractor shall be responsible for visual inspection and necessary correction of all deficiencies in materials and workmanship in accordance with the requirements of AWS D1.1.

M. The contractor shall comply with all requests of the Inspector(s) to correct deficiencies in materials and workmanship as provided in the contract documents.

N. In the event that faulty welding or its removal for re-welding damages the base metal so that in the judgment of the Engineer its retention is not in accordance with the intent of the contract documents, the contractor shall remove and replace the damaged base metal.

O. All structural welds shall be visually inspected and all complete penetration welds shall be ultrasonically tested by a qualified inspector. Joint fit-up of all complete penetration and partial penetration welds shall be inspected and approved by a qualified inspector prior to making the first pass.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Material certification stating source of steel.
3. Certificates of Welders.

END OF SECTION 05 10 00

SECTION 05 21 00 - STEEL JOISTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to fabricate, deliver, unload, handle, store and erect all open-web steel joists and girders, including accessories, as indicated, noted, detailed and scheduled on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. All shop and field welders must hold a current and valid certificate issued by the American Welding Society. Certificates shall be carried and presented upon request of Architect/Engineer.

1.03 REFERENCES

A. Publications of the following institutes, associations, societies and agencies are referred to in this Section.
   1. American Society for Testing Materials (ASTM).
   2. Steel Joist Institute, SJI.
   3. American Welding Society, AWS.
   4. American Institute of Steel Construction, AISC.
   5. Steel Structures Painting Council, SSPC.

B. Comply with the applicable portions of the latest additions of the following codes, specifications, standards and publications:
   1. "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", AISC.
   2. "Standard Specifications, Load Tables and Weight Tables for Steel Joist Girders", SJI.
   3. " Structural Welding Code ", AWS.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Prior to fabrication, furnish to the Architect/Engineer for his approval, complete shop and field erection drawings.
   2. Shop drawings shall include joist layout, location, size, quantities, type, marking, dimensions, spacing, erection details, connection details and bridging details.
   3. Indicate methods of anchoring, fastening, bracing and attachment.
   4. Each member shown on the shop drawings shall be marked in such a manner that the member designations of the drawings coincide with member designations on the member in the field.
   5. Review of shop drawings shall be for conformance with the contract documents regarding arrangement and sizes of members and the contractor's interpretation of the design loads and contract document details. Such review shall not relieve the contractor of full responsibility for the design and fabrication of the steel joists and joist girders.
   6. Connection details not indicated on the drawings to be designed by a licensed professional engineer, and certified designs to be indicated on shop drawings.

B. Certifications:
   1. All steel joists shall be produced by an S.J.I. member.
   2. All shop drawings shall bear the seal and signature of an engineer registered in the state where the joists will be erected, who shall certify that the joists are designed and fabricated in accordance with the A.I.S.C. and S.J.I. specifications.
   3. Provide materials certification including origin of steel. Provide evidence and certification of use of United States Steel products.

1.05 DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries in sufficient quantities to permit continuity of erection.

B. Store on blocks off ground and cover to prevent rusting, denting and damage to materials or structure.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Provide products of one of the following or an approved equivalent:
   1. Canam Steel Corporation
   2. New Millennium Building Systems
   3. Southern Metal Products, Louisville, KY
   4. Valley Joists Division of EBSCO Industries, Inc.
   5. Vulcraft Division of Nucor Corporation.

2.02 MATERIALS

A. Materials shall conform to the following requirements:
   1. "Structural Steel", ASTM Designation A36.
   2. "High Strength, Low-Alloy Structural Manganese Vanadium Steel", ASTM Designation A441.
   3. "High Strength Low-Alloy Structural Steel", ASTM Designation A242.
   4. "Steel Sheet and Strip, Hot-Rolled and Cold-Rolled, High Strength, Low-Alloy with Improved Corrosion Resistance", ASTM Designation A606.
   5. "Steel, Cold-Rolled Sheet, Carbon, Structural", ASTM Designation A611.
   6. "Mild Steel Arc-Welding Electrodes", AWS Bulletin.

B. Yield point of steel for chord and web sections: as specified in the "Standard Specifications", SJI.

C. Welding electrodes:
   1. E60 Series, Grade SAW-1 for 36,000 psi yield point.
   2. E70 Series, Grade SAW-2 for yield point greater than 36,000 psi.

D. Shop Paint: Type 1, oil alkyd, red or gray oxide to minimum 2 mil dry film thickness

2.03 FABRICATION

A. Design of steel joists and joist girders shall be the sole responsibility of the contractor, joist manufacturer and joist engineer.

B. Completely shop fabricate joists including punching for attachments.

C. Fabricate in accordance with "Standard Specifications", SJI.

D. Joists shall be welded construction of one manufacturer throughout and shall conform to current standard specifications for open web steel joist of the Steel Joist Institute and the American Institute of Steel Construction. They shall be of the type, sizes and spacing shown on the drawings.

E. Joists shall have ceiling extensions or extended bottom chords wherever ceilings of any type are to be installed beneath same, and/or where indicated on the drawings, or otherwise specified herein.

F. Joist girders shall be designed by the joist manufacturer for the loads as indicated on the drawings and in accordance with the specifications of the Steel Joist Institute, with the following additional requirements:

1. The maximum deflection due to design live load of 30 PSF shall not exceed 1/360 of the span length.
2. Joist girders shall have approximate cambers as recommended by the standard specifications for joist girders.

G. Joist manufacturer shall design roof joists for a net uplift (due to wind loading) of 10 PSF. Diagonal bridging or bracing to laterally brace the bottom chord shall be provided as required.

H. Steel joists and joist girders designated "special" (special, non-standard) shall be designed by the manufacturer for the loads indicated on the drawings. Design shall conform to AISC and SJI standard specifications and shall be performed by a registered professional engineer.

I. Provide additional L2x2x3/16 diagonals and field weld at all points where equipment is hung from the chords of the joists. The angle shall extend from the point of load application to the closest panel point in the opposite chord member.

J. Provide misc. angle framing between joists as required at all roof drains and misc. roof penetrations.

K. Provide all indicated or required accessories.
1. Bridging:
   a. Horizontal bracing for l/r ratio of not more than 300.
   b. Connect to chords by positive mechanical means or by welding.
2. End anchorage for masonry supports for K series joists: equivalent of 3/8 inch round steel bar 8 inch long.
3. Weld roof joist bearing on masonry walls to separate steel bearing plates furnished and installed by others.
4. Connect K Series joists bearing on steel to same with two 1/8 inch fillet welds 1 inch long or as indicated.
5. Side wall anchors: extended zee.
6. Headers: standard with the manufacturer. Furnish as required.
7. Ceiling extensions: bottom chord extended.

2.04 SHOP PRIMING

A. Before shop priming, clean surfaces free from rust, scale, grease and oil in accordance with SSPC Specifications SP3.
1. Joist shall be sprayed or dipped with one shop coat of primer paint, standard with the manufacturer, to a minimum dry film thickness of 2 mils.
2. Primer to be Standard Type 1, red oxide "10-99" or equivalent.

PART 3 - EXECUTION

3.01 FIELD MEASUREMENTS

A. The Contractor is responsible for obtaining all necessary field measurements at the project site and will be held responsible for their accuracy and for the accurate fitting of this work with the work of others.

3.02 BEARING AND ANCHORAGE

A. Minimum bearing for joists on structural steel members and steel bearing plates shall be 2-1/2 inches.

B. Minimum bearing for joists on masonry without steel bearing plates shall be 4 inches.

C. Ends of joists bearing on steel supports shall be connected thereto with two 1/8 inch fillet welds 2 inches long, unless otherwise shown or noted.

D. Ends of joists bearing on masonry shall be anchored thereto with standard masonry anchors approved by the Architect, unless otherwise shown or noted.

E. Set joists at proper elevations with required bearing and spacing as indicated on the drawings.

3.03 BRIDGING

A. Bridging shall be as required by the A.I.S.C. and SJI Standard Specifications and/or as indicated on plans.

B. Bridge joists immediately after erection and before any construction loads are applied on the joists.

C. Anchor the ends of bridging lines terminating at all beams and masonry walls at top and bottom chords. Anchored by strap anchors attached directly to the wall.

D. Bridging shall support top chords against lateral movement during construction period and hold joists in vertical plane.

3.04 ERECTION

A. Anchor joists parallel to walls with side wall anchors securely built into the masonry at each end of bridging lines.

B. Install headers as required or indicated.

C. Provide temporary flooring, bracing, shoring, rails, guards and covers as necessary to prevent injury or damage.

D. Temporarily fasten partially erected steel joists during interruptions in erecting.

E. Care shall be exercised at all times to avoid damage through careless handling during unloading, storing and erecting. Dropping of joist shall not be permitted and shall be cause for rejection.

F. Place and secure steel joists as shown on plans in accordance with A.I.S.C. and SJI Specifications and as specified herein.

G. Install joists straight, plumb and properly aligned.

H. Immediately after installation, clean field welds and abraded areas of shop paint and paint such areas with same material as used for shop painting to restore the protective coating to conditions equal to undamaged surfaces.

3.05 CLEAN-UP

A. Remove dirt, stains and other foreign material caused by erection of steel joists from adjacent surfaces.

B. Remove dirt and other foreign matter from steel joists and leave in clean satisfactory condition to receive specified finish. If joists are not to receive finish, then leave joists clean and free of dirt and extraneous materials.

C. Remove and replace joists that cannot be cleaned satisfactorily.

3.06 TOUCH-UP

A. At completion of erection, touch-up scratched, skinned or abraded spots as required.

SUBMITTAL CHECK LIST

1. Complete shop fabrication drawings.
2. Complete erection drawings.
3. Engineer's certification.
4. Materials certification including origin of steel.

END OF SECTION 05 21 00

SECTION 05 31 23 - METAL ROOF DECKING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to fabricate, deliver, unload, handle, store and erect all metal roof decking, including accessories, as indicated, noted, detailed and scheduled on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Comply with the applicable portions of the latest additions of the following codes, specifications, standards and publications:
   1. "Specifications for the Design of Cold-Formed Steel Structural Members", AISC.
   2. "Steel Deck Design Manual", SDI.
   3. "Basic Design Specifications", SDI.
   4. "Structural Welding Code", AWS.

1.03 REFERENCES

A. Publications of the following institutes, associations, societies and agencies are referenced in this Section.
   1. American Society for Testing and Materials, ASTM.
   2. Steel Deck Institute, SDI.
   3. American Iron and Steel Institute, AISI.

B. All metal decking and accessory items shall be domestic products and materials. Imported products will not be approved, allowed or used.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Prior to fabrication, furnish to the Architect/Engineer for his approval, complete shop and field erection drawings.
   2. Shop drawings shall include deck layout, orientation, profile, location, size, quantities, type, marking, dimensions, spacing, erection details, connection details, materials, gauges and sizes, supplementary framing, special jointing and accessories.
   3. Indicate method of connecting, anchoring, fastening and attachment of work of other trades.
   4. Indicate by dimensions, locations and sizes of holes to be cut, type of closures and fittings.

B. Certifications:
   1. Provide materials certification including origin of steel. Provide evidence and certification of use of United States Steel products.

1.05 DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries in sufficient quantities to permit continuity of installation.

B. Store on blocks off ground and cover to prevent rusting, denting and damage to materials or structure.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Metal Decking:
   1. Inryco, Inc.
   2. Vulcraft.

3. Rollform Products, Inc.
4. Wheeling Corrugating Company.
5. Metal Dek Group.

B. Mechanical Fasteners:
1. Hilti.
2. Buildex, Inc.

2.02 MATERIALS

A. Materials shall conform to the following requirements:
1. ASTM Designation A611 for Grade C.
2. ASTM A653-94 Structural Quality Grade 80.
3. ASTM A653-94, coating class G90 for factory galvanizing.

B. All Types of Metal Form Roof Decking:
1. Basic steel shall be flat rolled, sheets of structural quality with minimum yield of 33,000 psi, and working stress not to exceed 20,000 psi.
2. Decking shall be sheet steel, factory galvanized.
3. Provide a minimum section modulus shall be .234 in.3.
4. Sheets shall be continuous for at least 3 spans, where possible.
5. Accessories shall be standard with the manufacturer and shall be furnished as necessary to complete the roof deck installation.
6. Design and profile shall be in accordance with latest edition of Steel Deck Institute Design Manual.

2.03 FABRICATION

A. Typical Roof Deck:
1. Type B, fluted section.
2. 20 gauge, minimum.
3. 1-1/2 inches fabricated depth with flutes spaced at 6 inches o.c.

B. Provide and install accessory items as required to complete installation:
1. 18 gauge galvanized steel bent plates and closures.
2. Galvanized sheet steel.
3. Steel supports for roof openings over a distance of 12 inches.

C. Design:
1. Maximum fiber stress shall not exceed 20,000 PSI under a total dead and live load of 50 PSF.
2. Deflection shall not exceed 1/360 of the span under a live load of 30 PSF, nor shall it exceed 1/240 of the span under a total dead and live load of 50 PSF.
3. Technical literature showing the configuration, load capacity, section properties and other pertinent data shall be submitted as a part of the shop drawings.

PART 3 - EXECUTION

3.01 FIELD MEASUREMENTS

A. The Contractor is responsible for obtaining all necessary field measurements at the project site and will be held responsible for their accuracy and for the accurate fitting of this work with the work of others.

3.02 PROTECTION, STORAGE AND HOISTING

A. The metal roof decking shall be protected against damage in transit to the job site.

B. If site storage is necessary, metal roof decking shall be stacked on wood blocking clear of the ground

and sloped slightly to insure against the entrapment of water.

C. Hoisting of the metal roof decking to floor designated on the shop drawings shall be done in such a manner as to not damage the material and placed to provide as little rehandling as possible.

3.03 INSTALLATION

A. Installation shall be in strict accordance with the final shop drawings and requirements herein. Decking units shall be handled in such a manner as to avoid damaging the units. Decking units shall be placed only over supports which have been accurately aligned and secured in position.

B. Install decking level and true to a line according to details of approved setting drawings. Install decking with ribs perpendicular to bearing. Shop cut ends to correct angle to meet bearings.

C. If connection notes and details are not indicated on the drawings, secure decking to supporting steel members by use of mechanical fasteners only. Welding attachment is not acceptable.
   1. Self-drilling and tapping fasteners.
   2. Install fasteners in strict accordance with manufacturer's specifications.
   3. Fastener Schedule:
      a. #12 x 1-1/4", Type 5 point for deck to steel joist, angles or structural steel.
      b. #14 x 7/8", Type 1 point for deck to deck side laps (stitching).
   4. Fastener spacing:
      a. 6 inches on center, maximum, at end laps.
      b. 12 inches on center, maximum, at intermediate supports.
      c. 15 inches on center, maximum, at side laps of adjacent units.
      d. Provide a minimum 2 fasteners on side laps between supports.

D. End Laps:
   1. 2 inch minimum and occur over supports.
   2. Laps shall be tight but made without stretching.

E. Side Laps:
   1. Make by "nesting" to interlock with adjacent sheets.
   2. Attach edges with mechanical fastener supports.
   3. Laps shall be tight but made without stretching.

F. Openings:
   1. Cut and neatly fit deck units and accessories around other work projecting through or adjacent to decking.
   2. Reinforce decking around openings with sheet steel.
   3. No openings larger than 12 inches x 12 inches will be permitted without support by structural steel framing.

G. Provide accessories necessary for proper installation.
   1. Secure accessories to decking as recommended by manufacturer of decking.
   2. Install items specified in other sections as furnished for installing with decking.

H. Attention is called to the fact that the metal decking is designed for diaphragm action. Therefore, added care must be taken to ensure proper installation procedures.

3.04 TOUCH-UP

A. Touch-up all scratched, abraded or rubbed spots with galvanized or primer paint.

3.05 CLEAN-UP

A. Remove foreign matter and clean decking to satisfactory conditions to receive specified finish.

3.06 INSPECTION

A. The contractor shall retain a testing company to ensure and certify that the deck is fastened properly, prior to placement of cover materials.

B. Written approval of deck installation is required prior to proceeding with construction.

SUBMITTAL CHECK LIST

1. Complete shop fabrication drawings.
2. Complete erection drawings.
3. Materials certification including origin of steel.

END OF SECTION 05 31 23

SECTION 05 41 00 - COLD FORMED LIGHTGAGE METAL FRAMING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. All exterior and curtainwall steel stud construction as shown on Drawings and specified herein.

B. All load bearing interior steel stud construction as shown on Drawings and specified herein.

C. See Section 09 29 00.01 - Gypsum Drywall for all framing for non-load bearing interior partitions and framing.

D. Furnish labor, materials, equipment, special tools, supervision and services required to fabricate, deliver and erect all Lightgage Metal Framing indicated noted and detailed on Drawings and specified herein.

E. The extent of work is shown on the drawings using a C steel stud and joist system. All connections are welded.

1.02 QUALITY ASSURANCE

A. All shop and field welders must hold a current and valid certificates issued by the American Welding Society.

B. Component Design: Compute structural properties of studs and joists in accordance with AICS "Specification for Design of Cold-Formed Steel Structural Member". Comply with AISI S220 and S240 for design and installation of cold formed steel light frame construction. For purposes of this specification, the terms “lightgage” and “light frame” are synonomous. Connectors to be SFIA certified.

C. Product Designation:
1. As specified in the AISI standard for cold formed steel framing
2. Four-part identification code. Example: 600S162-43
   a. 600 6”
   b. S Stud or Joist Section
   c. 162 1.625” flange width
   d. 43 .043” mill thickness
   e. Minimum flange size for non-load bearing components is 1-1/4”.
   f. Minimum flange size for load bearing components, and components resisting lateral loads is 1-5/8”.

D. Engage a registered engineer, licensed in the state where the project is located, to design load bearing components and components resisting lateral loads.

1.03 SUBMITTALS

A. Submit manufacturer's product information and installation instruction for each item of lightgage framing and accessories.

B. Submit shop drawings for load bearing components and components resisting lateral loads, sealed by the licensed engineer. Indicate all connection details on the shop drawings. Design legs on deflection tracks to comply with deflection criteria listed on Drawings, or if not indicated, to minimum requirements of applicable building code.

C. Furnish the Architect/Engineer with certificates of all AWS Certified welders who will perform work on

this project.

1.04 DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries in quantities to permit continuity of installation.

B. Store on blocks off ground and cover to prevent rusting, denting and damaging to materials or structure.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products from one of the following manufacturers, or an approved equivalent:
1. "U.S. Gypsum Company" (USG).
2. "National Gypsum Company".
3. "Georgia-Pacific".
4. “Clark Dietrich Building Systems”.
5. “Phillips Manufacturing Co.”.
6. “Marino/Ware”.
7. “CEMCO Steel”.
8. "Flex-Ability Concepts".
9. “MBA Metal Framing”.
10. “Dale/Incor”.
11. “Superior Steel Studs”.

2.02 SYSTEM COMPONENTS

With each type of metal framing required, provide manufacturer's standard runners (tracks), shoes, clips, ties, stiffeners, fasteners, grommets to protect electrical wiring, and accessories as recommended by the manufacturer for the applications indicated, as needed to provide a complete metal framing system, and as otherwise indicated.

2.03 STUDS

A. Manufacturer's C steel studs complying with ASTM A446, of the height, size and gauge indicated; with punched webs to facilitate erection of system and passage of mechanical/electrical service lines.

B. Thickness:
a. Interior: As indicated on Drawings, or if not indicated, 18 gauge minimum.
b. Exterior: As indicated on Drawings, or if not indicated, 16 gauge minimum.
c. Other gauges as and where otherwise indicated.

C. Depth of Section: as indicated on Drawings.

D. Flange Width: Not less than 1.625” (1-5/8").

E. Steel and Finish: ASTM A 446-76, Galvanized Steel, Class A.

F. Face of Flanges: Knurled to facilitate use of self-drilling, self-tapping fasteners.

G. Lateral Bracing: 1-1/2" cold rolled channels.

2.04 FABRICATION

A. Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb,

square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion.

B. Attach similar components by welding. Attach dissimilar components by welding or bolting as standard with manufacturer and approved by the architect.

C. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Prior to the start of installation of lightgage metal framing system, meet at the project site with the installers of other work including E.I.F.S., metal panel, mechanical, and electrical work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing work.

3.02 INSTALLATION

A. Install lightgage metal framing in accordance with manufacturer's printed or written instruction and recommendations, unless otherwise indicated.

B. Runner Tracks:
1. Install continuous tracks sized to match studs.
2. Align tracks accurately to the layout at base and tops of studs.
3. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24 inches o.c. spacing for nail or power-driven fasteners, nor 16 inches o.c. for other types of attachment.
4. Provide fasteners at corners and ends of tracks.

C. Where stud systems abut ceiling or deck construction or vertical structural elements, provide slip or cushion-type joint between stud system and structure as recommended by stud manufacturer to prevent the transfer of structural loads or movements to stud systems.

D. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

E. Where stud system abuts structural columns or walls, anchor ends or stiffeners to supporting structure.

F. Install supplementary framing, blocking and bracing in the metal stud system wherever indicated to support fixtures, services, heavy trim and similar work requiring attachment to the system. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.

G. Install continuous horizontal lateral bracing at 5'-0" o.c. in all exterior walls, and where recommended by manufacturer.

H. Frame both sides of expansion and control joints with a separate stud and do not bridge the joint with components of the stud system.

I. Where soffits abut other construction, install vertical runner track anchored not more than 24 inches o.c. to other construction.

J. At soffit corners and intersections, install a minimum of 3 studs to provide support for each surface.

Space studs 2 inches away from internal corner lines to finished partition.

K. Except as otherwise indicated space studs at 16 inches o.c.

L. If welding is required for connection to structural or miscellaneous steel, noted on the drawings or contractor elects to weld, it shall be in accordance with stud manufacturer's recommendations.

SUBMITTAL CHECK LIST

1. Manufacturer's specifications.
2. Manufacturer's installation instructions.

END OF SECTION 05 41 00

SECTION 05 50 00 - MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Miscellaneous metals include items made from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems specified elsewhere.

B. Types of work in this section include, but are not limited to the following:
   1. Steel Pipe Railings and Brackets.
   2. Loose Steel Lintels.
   3. Miscellaneous Framing and Supports.
   4. Steel Concrete Inserts.
   5. Pipe Bollards.

1.02 QUALITY ASSURANCE

A. Comply with the applicable requirements of the following manuals, specifications and codes:
   1. "Specification for Design, Fabrication and Erection of Structural Steel for Buildings", AISC.
   2. "Code for Arc and Gas Welding in Building Construction", AWS.
   3. "Structural Steel Detailing", AISC.

1.03 REFERENCES

A. Publications of the following institutes, associations, societies and agencies are referred to in this Section.
   1. American Society for Testing and Materials, ASTM.
   2. National Association of Architectural Metals Manufacturers, NAAMM.
   3. Steel Structures Painting Council, SSPC.
   4. American Welding Society, AWS.
   5. American Institute of Steel Construction, AISC.

B. All Miscellaneous Metals and fabricated items shall be domestic manufacture. Imported metals and products will not be approved or used.

1.04 SUBMITTALS

A. Furnish to the Architect for approval, complete shop and field erection drawings.

1.05 DELIVERY, STORAGE AND HANDLING

A. Fabricate and deliver miscellaneous metal items in ample time to avoid delays in the progress of any trade working on the project.

B. Store on blocks off ground and cover to prevent rusting, denting and damage to materials or structure.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall conform with the following requirements:
   1. "Structural Steel", ASTM Designation A36.
   2. "Low and Intermediate Tensile Strength Carbon Steel Plates of Structural Quality", ASTM Designation A283.
   3. "Cold-Rolled Carbon Sheets, Commercial Quality", ASTM Designation A36.

B. Structural Steel: 36,000 psi yield point rolled to the size and shapes indicated on the drawings.

C. Welding Electrodes: Series #70, Grade AWS-2.
D. Primer Paint: Supplier's standard shop primer paint.

2.02 MISCELLANEOUS METAL ITEMS
A. Miscellaneous Metal Items but are not necessarily limited to the following:
1. Steel angles, shelf angles, receiving angles, lintels and miscellaneous supports requiring fabrication.
2. All bolts, inserts, clip angles, struts and channel framing.
3. Handrails shall be steel pipe with welded joints. All welds shall be ground smooth. Provide closure plates at ends of all rails. Return all ends to wall unless otherwise detailed.

2.03 WORKMANSHIP
A. Workmanship required in the execution of the work shall be of the best quality and subject to the approval of the Architect.

B. Form metal work to shape and size, with sharp lines and angles. Leave clean, true lines and surfaces when shearing or punching. Weld permanent connections where practical.

C. Holes in structural steel framing for attaching miscellaneous metal items will be provided by the miscellaneous metal erector.

2.04 FABRICATION
A. The Contractor is responsible for verifying all dimensions of work adjoining. Inspect such work before fabrication and/or installation of items specified. Obtain measurements of adjoining work so work will fit closely to spaces provided.

B. Provide opening angles, lintels and miscellaneous supports shown, requiring fabricating in accordance with notes and details.

C. The fabricator shall furnish all necessary templates and patterns required by other trades. Also furnish all items except otherwise specified, pertaining to work under other sections.

2.05 SHOP PAINTING
A. Clean all ferrous metals of all rust, scale, oil, grease or other foreign matter in accordance with SSPC Specification SP2-63.

B. After cleaning apply one coat Type 1, oil alkyd, red oxide to minimum 2 mil dry film thickness

C. All exterior miscellaneous steel to be hot dipped galvanized.
1. Hot dip galvanizing per ASTM A123, min. 2.0 ounces per square foot.
2. Touch up primer: SSPC 20, Type I inorganic zinc rich.

PART 3 - EXECUTION

3.01 FIELD MEASUREMENT
A. The Contractor is responsible for obtaining all necessary field measurements at the job site and will be held responsible for their accuracy and for the accurate fitting of this work with the work of others.

3.02 GENERAL

A. Perform all cutting, fitting and drilling necessary to properly set the work herein specified and as required for proper installation of adjacent or engaging work of all trades.

3.03 ADJUST AND CLEAN

A. Touch Up Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting.
   2. Apply to provide a minimum dry film thickness of 2.0 mils.

SUBMITTAL CHECK LIST

1. Shop and setting drawings.

END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete all rough carpentry work indicated, noted and detailed on drawings and specified herein including:
   1. Framing, blocking and furring.
   2. Wood treatment.
   3. Fasteners in treated wood.
   4. Blocking as required for items such as casework, cabinets, toilet accessories, lockers, and any other items requiring wood blocking for support, bracing, mounting, and securing in place.

1.02 QUALITY ASSURANCE

A. Grading Rules:
   1. Lumber grading rules and wood species shall conform with Voluntary Product Standard PS-20. Grading rules of the following associations shall also apply to materials produced under their supervision.
      a. Northeastern Lumber Manufacturer's Association, Inc. (NELMA).
      b. Southern Pine Inspection Bureau (SPIB).
      c. West Coast Lumber Inspection Bureau (WCLIB).
      d. Western Wood Product Association (WWPA).
   2. Plywood shall conform to the following:
      a. Softwood Plywood - Product Standard PS-1.
      b. Hardwood Plywood - Product Standard PS-51.

B. Grade Marks:
   1. Identify all lumber and plywood by official grade mark.
   2. Lumber: Grade stamp to contain symbol of grading agency, mill number or name, grade of lumber, species or species grouping or combination designation, rules under which graded, where applicable and condition of seasoning at time of manufacture.
      a. S-Dry: Maximum 15 percent moisture content.
      b. MC-5 or KD: Maximum 15 percent moisture content.
      c. Dense.
   3. Softwood Plywood: Appropriate grade trademark of the American Plywood Association.
      a. Type, grade, class and identification index.
      b. Inspection and testing agency mark.
   4. Hardwood Plywood: Appropriate grade mark of qualified inspection, testing, or grading mark.

C. Testing:
   1. ASTM E 84, maximum 25 Flame Spread rating.

D. Requirements of Regulatory Agencies:
   1. Fire Hazard Classification: Underwriter's Laboratories, Inc., for treated lumber and plywood.
   2. Preservative Treated Lumber and Plywood: American Wood Preservers Bureau, Quality Mark.
   3. Pressure Treated Material: American Wood Preserves Bureau Standards.
   4. Span Tables: National Forest Products Association.
   5. Working Stresses: Softwood Lumber, National Design Specification, National Forest products Association.

1.03 SUBMITTALS

A. Submit the following:

1. Treating Plant Certification:
   Submit certification by treating plant stating chemicals and process used, net amount of salts retained, and conformance with applicable standards.
2. Preservative Treated Wood:
   Submit certification for water-borne preservative that moisture content was reduced to 19 percent maximum, after treatment.
3. Fire Retardant Treatment:
   Submit certification by treating plant that fire-retardant treatment materials comply with governing ordinances and that treatment will not bleed through finished surfaces.
4. Fasteners Product Data:
   Submit manufacturer's published literature and product data sheets.

1.04 DELIVERY, STORAGE AND HANDLING

A. Immediately upon delivery to job site, place materials in area protected from weather.

B. Store materials of minimum of 6" above ground on framework or blocking and cover with protective waterproof covering, providing adequate air circulation or ventilation.

C. Do not store seasoned materials in wet or damp areas.

D. Protect fire-retardant materials against high humidity and moisture during storage and erection.

E. Protect sheet materials from corners breaking and surface damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber:
   1. Dimension:
      a. Specified lumber dimensions are nominal.
      b. Actual dimensions conform to industry standards established by the American Lumber Standards Committee and the rules writing agencies.
   2. Moisture Content:
      a. 19 percent maximum at time of permanent closing of building or structure, for lumber 2" or less nominal thickness.
   3. Surfacing:
      a. Surface four sides (S4S), unless otherwise shown, or specified.
   4. Framing Lumber:
      a. 2" to 4" thick, 2" to 4" wide.
      b. Any commercial softwood species, unless otherwise shown, or specified.
   5. Miscellaneous Lumber:
      a. Provide wood for support or attachment of other work including cant strips, bucks, nails, blocking, furring, grounds, stripping and similar members.
      b. Provide lumber of sizes shown or specified, worked into shapes shown on Drawings.
      c. 15 maximum moisture content for lumber items not specified to receive wood preservative treatment.
   6. Grades:
      a. General Framing: Standard and Better Grade.
      b. Plates, Blocking, Bracing and nailers: Utility Grade.
      c. Miscellaneous Lumber: Construction Grade.

B. Plywood:
   1. Exterior graded plywood where indicated, or where edge or surface is permanently exposed to weather: B-B EXT-APA, graded for treatment where preservative treated plywood is indicated.
   2. Plywood Backing Panel: For mounting electrical or telephone equipment, provide fire-retardant treated plywood panels, APA C-D PLUGGED INT with exterior glue, thickness indicated, or if not otherwise indicated, 3/4".

C. Preservative Treated Wood:
   1. Waterbourne Salt Preservatives for Painted, Stained or Exposed Natural Wood Products:
      a. AWPB LP-2, above ground application.
      b. AWPB LP-22, ground contact application.
   2. Treat indicated items and the following:
      a. Wood sills, sleepers, blocking, furring, stripping, roofing, and similar concealed members in contact with masonry, concrete, or around windows and doors.
      b. Use **MCA** (Micronized Copper Azole) preservative treatment only.

D. Fire Retardant Treatment:
   1. Comply with AWPA Standards for pressure impregnation with fire retardant chemicals.
      a. Flame Spread: 25 max.

E. Fasteners in Treated Wood:
   1. Shall be resistant to corrosion or be protected to resist corrosion.
   2. Where sacrificial coatings are applied to fasteners, a minimum coating thickness capable of protecting the fastener for the expected service life of the structure shall be provided. Provide manufacturer's product information, test results, and certifications to substantiate these claims.
   3. Coating weights for zinc-coated fasteners shall be in accordance with ASTM A153M or ASTM A641, Supplementary Requirements.
   4. Fasteners shall be one of the following:
      a. Stainless steel.
      b. Standard Single-dipped, Double-dipped, Hot-dipped, or zinc-coated galvanized steel.
      c. Silicon bronze.
      d. Copper.

PART 3 - EXECUTION

3.01 GENERAL

A. Discard units of material with defects which might impair quality of work, and units which are too small to fabricate work with minimum joints or optimum joint arrangement.

B. Set carpentry work accurately to required levels and lines, with members plumb and true and accurately cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as shown and as required by recognized standards. Countersink nail heads on exposed carpentry work and fill holes.

D. Use common wire nails except as otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

3.02 INSTALLATION

A. Wood Grounds, Nailers, Blocking and Sleepers:

1. Provide where shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached.
2. Attach to substrates as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise shown. Build into masonry during installation of masonry work. Where possible, anchor to formwork before concrete placement. Do not use power driven anchors unless approved by Architect.
3. Provide permanent grounds of dressed, preservative treated, key-beveled lumber not less than 1-1/2" wide and of thickness required to bring face of ground to exact thickness of finish material involved. Remove temporary grounds when no longer required.
4. For renovation projects utilizing existing blocking, provide additional blocking as required if existing blocking is inadequate.

B. Apply two brush coats of same preservative used in original treatment to all sawed or cut surfaces of treated lumber.

3.03 TEMPORARY WORK

A. Provide temporary stairs, ramps, runways, ladders, etc., as required for the purpose of handling materials, personnel and access to the work and temporary exits from the building.

3.04 CUTTING, FITTING AND PATCHING

A. Include all cutting, fitting and patching of work in connection with other trades which adjoin any part of this work.

SUBMITTAL CHECK LIST

1. Treating plant certification.
2. Preservative treatment certificate.
3. Fire retardant treatment certificate.
4. Fasteners product data.

END OF SECTION 06 10 00

SECTION 06 20 00 - FINISH CARPENTRY

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Carpentry work which is exposed to view, as shown on the Drawings and specified herein.

B. Solid Surface window sills throughout the project as indicated on the Drawings.

C. Aluminum sliding window assembly.

1.02 QUALITY ASSURANCE

A. Comply with the latest edition of the Architectural Woodwork Standards (AWS) “Quality Standards”. References to Premium, Custom, or Economy in this specification are to be as defined in this publication.

B. Factory mark each piece of lumber and plywood with grading information, except for surfaces to receive transparent finish.

C. Mark each unit of fire-retardant treated lumber and plywood with Underwriter's Laboratory Classification marking.

1.03 SUBMITTALS

A. Submit the following:
   1. Shop Drawings of all finish carpentry items of sufficient detail and scale to show compliance with design intent and specified quality grades.
   2. Samples of all finish materials for colors, patterns and finishes as specified.
      For colors, patterns and finishes not specified, submit samples of manufacturer's entire selection for selection by Architect.

1.04 DELIVERY, STORAGE AND HANDLING

A. Protect woodwork during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

B. Do not deliver woodwork, until painting, wet work, grinding and similar operations which could damage, soil or deteriorate woodwork have been completed in installation areas.

1.05 PROJECT CONDITIONS

A. Conditioning: Do not install woodwork until required temperature and relative humidity have been stabilized and will be maintained in installation areas.

B. Maintain temperature and humidity in installation area as required to maintain a moisture content of installed woodwork within a 1.0 percent tolerance of optimum moisture content, from date of installation through remainder of construction period.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hardwood Plywood:
   1. Product Standard PS 51.

B. Softwood Plywood:
   1. Product Standard PS 1.

C. Solid Wood for Painted Finish:
   1. Poplar, AWS, Custom Grade.

D. Particle Board:
   1. Medium Density, Type 1-M-2.
   2. Thickness as indicated on the Drawings. If not indicated, provide 3/4” standard.

E. Provide kiln-dried (KD) lumber with an average moisture content range of 6% to 11% for interior work. Maintain temperature and relative humidity during fabrication, storage and finishing operation so that moisture content values for woodwork at the time of installation do not exceed 5% to 10%.

F. Miscellaneous Materials:
   1. Provide nails, screws and other anchoring devices to provide secure, concealed attachment.
   2. Where finish carpentry is exposed to exterior or areas of high humidity, provide fasteners with hot-dipped zinc coating (ASTM-A153).

G. Fire Treated Wood:
   1. ASTM - E84
   2. Flame Spread - 25 max.
   3. Kiln-dried after treatment to 15% max. moisture content.

H. Fasteners and Anchors:
   1. Size and type as required for each use.
   2. Provide non-ferrous or hot-dip galvanized anchors and fasteners for all exterior applications.

I. Solid Surface Window Sills:
   1. Acceptable Manufacturers and Products:
      a. "Dupont", "Corian".
      b. "Wilsonart", "Gibraltar".
      c. "Formica", "Formica Solid Surfacing".
   2. 3/4” total sill thickness provided from one of the following, depending on color availability:
      a. 3/4" thick solid surface material.
      b. 1/4" thick solid surface material laminated atop 1/2" plywood or hardboard with edge bandings of 3/4" solid surface material.
   3. Provide 1/2" thick apron below entire exposed edge of sill, 2” deep unless indicated otherwise.
   4. All sills and aprons to have eased exposed edges.
   5. Extend sill 1/2” beyond face of apron, unless indicated otherwise.
   6. Color as indicated on Drawings, or to be selected by Architect from manufacturer’s entire selection.

J. Aluminum Sliding Window Assembly:
   1. “Knape and Vogt” P1092 ANOD 48 Roll-Ezy Aluminum Track Assembly Kit
   2. Provide nylon wheels and all necessary trim and accessories for a complete installation of bi-pass window unit.
   3. Provide “Epco” Sliding Glass Door Lock - EPC-G05-C or approved equal.
   4. Color: Clear Anodized.
   5. Size of opening: as Indicated on Drawings.

2.02 FABRICATION

A. Fabricate standing and running trim of solid wood for transparent and opaque finish in accordance with AWS Section 300, Premium Grade.

B. Fabricate standing and running trim including sill, chair rail and railings to dimensions, profiles, and details shown. Rout or grove reverse side (backed-out) of trim members to be applied to flat surface, except for members with ends exposed in finish work. Miter corners and reinforce. Miters shall be well formed and in true alignment.

C. Fabricate flush veneer laminated paneling on interior hardwood plywood with veneer for transparent finish specified. Veneers shall be center matched. Panels shall be book matched and where they occur end to end they shall be end matched. Paneling shall conform with AWS Section 500A, Premium Grade.

D. Closet shelving up to 12 inches in width may be cut from solid wood for painted finish, or fabricated from particle board or plywood as specified for wider shelves. Shelves greater than 12 inches in depth shall be fabricated from particle board or plywood with glued solid lumber edge band in accordance with AWS Section 600, Custom Grade.

E. Provide solid hardwood edge banding on all exposed edges of finish carpentry.

PART 3 - EXECUTION

3.01 PREPARATION

A. Condition wood materials to average prevailing humidity of installation area prior to installing.

B. Discard unsuitable materials and remove from job site.

3.02 INSTALLATION

A. Install work in as large sizes as practical, in order to minimize the number of joints. Install trim using full length pieces from largest length lumber available. Stagger joints in adjacent and related members.

B. Install work plumb, level, true and straight. Shim as required using concealed shims.

C. Scribe and cut work to fit adjoining surfaces.

D. Miter trim at corners, cope at returns. Use scarf joints for end to end joints.

E. Install fire-retardant treated wood in accordance with manufacturer's directions and as required to meet required classification or rating. Provide special fasteners, molding, adhesives and other accessories for rating and fire-retardant material indicated.

F. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fastener heads are required, use fine finishing nail for exposed nailings, countersunk and filled flush with surface, so that nail is not noticeable after surface is painted or stained.

3.03 ADJUSTING AND CLEANING

A. Repair or replace defective finish carpentry work to eliminate functional and visual defects.

B . Adjust joinery for uniform appearance.

C. Refer to Division 9 sections for final finishing.

3.04 PROTECTION

A. Protect all work from damage until time of substantial completion.

B. Maintain conditions necessary to prevent deterioration of work.

C. Repair or replace damaged work and finishes.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Samples.

END OF SECTION 06 20 00

SECTION 07 21 00 - INSULATION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of insulation work is indicated on the Drawings and specified herein.

B. Applications of insulation specified in this section include the following:
1. Foundation Wall Insulation.
2. Batt/Blanket Thermal Insulation.
3. Batt/Blanket Sound Insulation.

1.02 QUALITY ASSURANCE

A. Thermal Conductivity:
Thicknesses shown are for thermal conductivity (k-value at 75°F) specified for each material. Provide adjusted thicknesses as directed for equivalent use of material having a different thermal conductivity. Where insulation is identified by "R" value, provide appropriate thickness.

B. Fire and Insurance Ratings:
Comply with fire-resistance, flammability and insurance ratings indicated, and comply with governing regulations as interpreted by authorities.

1.03 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and installation instructions for each type of insulation required.
2. Material Safety and Data Sheets (MSDS).

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Protection for Plastic Insulation:
1. Do not expose to sunlight.
2. Protect against ignition at all times. Do not deliver plastic insulation materials to project site ahead of installation time. Complete installation and concealment of plastic materials as rapidly as possible in each work area.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Foundation Wall Insulation:
1. Provide one of the following approved products:
a. "Dow Chemical Company", Styrofoam.
b. "Owens-Corning", Foamular.
2. Rigid, closed-cell, extruded polystyrene insulation board with integral high-density skin:
a. 25 psi minimum compressive strength.
b. K-value of 0.20.
c. 0.5% maximum water absorption.
d. Minimum value "R-5" per inch thickness, or as otherwise indicated on drawings.
e. Meeting all requirements of ASTM C578 Type IV.
3. Size:
a. Manufacturer's standard lengths and widths.

b. Thicknesses and R-Value as indicated on Drawings, or if not indicated, 2" thick, R-10.0 min.

B. Batt/Blanket Thermal Insulation (formaldehyde, acrylic and dye free):
1. Unfaced Batts:
a. Provide accepted products from one of the following acceptable manufacturers:
1.) "Owens Corning".
2.) "USG".
3.) “Johns Manville”.
4.) "CertainTeed".
b. Fiberglass Batts.
c. Continuous rolls in width of 16" or 24”, as required to accommodate building component spacing.
d. Thickness to completely fill stud space and also provide R-value indicated on drawings.
If not indicated, provide either 3-1/2" thick R-11 minimum or 6” thick R-19 minimum.
e. Provide unfaced batts for all batt/blanket thermal insulation, unless otherwise indicated.
2. Kraft Faced Batts:
a. Use of Kraft Faced Batts is NOT permitted.
3. Foil Faced Batts:
a. Provide accepted products from one of the following acceptable manufacturers:
1.) "Owens Corning".
2.) "USG".
3.) “Johns Manville”.
4.) "CertainTeed".
b. Fiberglass Batts.
c. Continuous rolls in width of 16" or 24”, as required to accommodate building component spacing.
d. Foil scrim vapor barrier facing, Class A rated, Type FSK-25.
e. Thickness to provide R-value indicated on drawings, or if not indicated, 3-1/2" thick, R-11.

C. Batt/Blanket Sound Insulation (formaldehyde, acrylic and dye free):
1. Fiberglass Batts.
a. Provide one of the following approved products:
1). "Owens Corning" Sound Attenuation Batts Fiber Glass.
b. Unfaced.
c. Continuous rolls in width of 16" or 24”, as required to accommodate building component spacing.
d. Thickness to completely fill stud space.
At a minimum, provide 3-1/2" thickness to provide NRC value of 1.00 minimum.
e. Friction fit between studs at partition walls, or as indicated on the drawings.
2. Mineral Wool Batts.
a. Provide one of the following approved products:
1). "Owens Corning" Sound Attenuation Fire Batts (Mineral Wool).
2). “Thermafiber” Safing Insulation.
b. Unfaced.
c. 48” lengths in width of 16" or 24”, as required to accommodate building component spacing.
d. 3” thick minimum to provide NRC value of 1.05 minimum.
e. Friction fit between studs at rated partition walls, or as indicated on drawings.

D. Miscellaneous Materials:
1. Adhesive for bonding insulating to be type recommended by insulation manufacturer and complying with fire-resistance requirements.
2. Mechanical anchors to be type and size shown, or if not shown, as recommended by insulation manufacturer for type of application and condition of substrate.

PART 3 - EXECUTION

3.01 INSPECTION

A. Installer must examine substrate and conditions under which insulation work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do no proceed with insulation work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General:
   1. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.
   2. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation.
   3. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

B. Perimeter Insulation:
   1. On vertical surfaces, set units in adhesive applied in accordance with manufacturer's instructions. Use type adhesive recommended by manufacturer of insulation.
   2. At interior side of foundation walls, extend insulation continuous from top of footing to bottom of slab.
   3. At exterior side of foundation walls, extend insulation from top of footing to grade line and cut top of insulation board along grade line as required.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 07 21 00

SECTION 07 21 19 – MEDIUM DENSITY CLOSED CELL POLYURETHANE FOAM AIR BARRIER

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of insulation work is indicated on the Drawings and specified herein.

B. This section includes the following:
   1. Materials and installation methods for a spray polyurethane foam building insulation and air/vapor barrier system located in the non-accessible part of the wall.
   2. SRAB (sheet rubberized-asphalt barrier) self-adhered air/vapor barrier membrane in roof assemblies.
   3. Materials and installation to bridge and seal the following air leakage pathways and gaps:
      a. Connections of the walls to the roof air barrier.
      b. Connections of the walls to the foundations.
      c. Seismic and expansion joints.
      d. Openings and penetrations of window frames, store front, curtain wall.
      e. Barrier precast concrete and other envelope systems.
      f. Door frames.
      g. Piping, conduit, duct and similar penetrations
      h. Masonry ties, screws, bolts and similar penetrations.
      i. All other air leakage pathways in the building envelope.
   4. Materials to act as flashings and counterflashings.

1.02 PERFORMANCE REQUIREMENTS

A. Provide air/vapor barrier system constructed to perform as a continuous air/vapor barrier system, as building thermal insulation, and as a liquid water drainage plane flashed to discharge to the exterior any incidental condensation or water penetration. System shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air seal materials at such locations, changes in substrate and perimeter conditions.

B. Provide materials with an air permeability not to exceed 0.004 cubic feet per minute per square foot under a pressure differential of 0.3 in. water (1.57 psf) (0.02 L/s.m2 @ 75 Pa.) when tested in accordance with ASTM E2178-01.

C. Material shall meet requirements of ULC S705.1 Standard for Thermal Insulation – Spray Applied Rigid Polyurethane Foam, Medium Density, and shall meet or exceed the following performance requirements:
   1. R value: 6.0 per inch minimum.
   2. Density: 1.9 pounds per cubic foot.
   3. Smoke developed: 450 max.
   4. Flame spread: 25 max. (ASTM E84)

D. Fire and Insurance Ratings:
   Comply with fire-resistance, flammability and insurance ratings indicated, and comply with governing regulations as interpreted by authorities.

1.03 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's product data sheets for each type of material, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

2. Submit manufacturer's installation instructions.
3. Provide evidence of testing by an accredited laboratory confirming material has been tested and conforms to the requirements of ASTM E2178, Standard for Air Barrier Materials.
4. Certification by air/vapor barrier manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).
5. Certification of compatibility by air/vapor barrier manufacturer, listing all materials on the project that it connects to or that come in contact with it.
6. Submit two samples, 12 by 12 inch (300 by 300 mm) minimum size, of each air/vapor barrier material required for Project.
7. Submit test results of air permeability testing of primary air barrier material (ASTM E 2178-01)
8. Submit test results of assembly in accordance with ABAA test protocol.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:
   1. The air barrier contractor shall be, during the bidding period as well as for the duration of the installation, shall be approved by the manufacturer.
   2. The applicator shall be thoroughly trained and experienced in the installation of air barriers of the types being applied.
   3. Single-Source Responsibility: Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.
   4. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
   5. Construct typical exterior wall panel, 4 feet long by 4 feet wide, illustrating materials interface and seals. All transition membranes and seals shall be installed per the manufacturer’s system requirements.
   6. Protect people and materials from over-spray and contact with chemicals and gases.

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not allow insulation materials to become wet, soiled, or covered with ice or snow. Comply with manufacturer's recommendations for handling, storage and protection during installation.

B. Protection for Plastic Insulation:
   1. Do not expose to sunlight.
   2. Protect against ignition at all times. Do not deliver plastic insulation materials to project site ahead of installation time. Complete installation and concealment of plastic materials as rapidly as possible in each work area.

C. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, expiration date, and directions for storage. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air/vapor barrier manufacturer. Protect stored materials from direct sunlight.

D. Avoid spillage. Immediately notify Owner if spillage occurs and start clean up procedures.

E. Clean spills and leave area as it was prior to spill.

1.06 WASTE MANAGEMENT AND DISPOSAL

A. Place materials defined as hazardous or toxic waste in designated containers. Ensure emptied containers are sealed and stored safely for disposal away from children.

1.07 PROJECT CONDITIONS

A. Environmental Conditions: Apply air/vapor barrier within range of ambient and substrate temperatures recommended by air/vapor barrier manufacturer. Do not apply air/vapor barrier to a damp or wet substrate, unless the manufacturer specifically permits that for the product.

B. Do not apply air/vapor barrier in snow, rain, fog, or mist.

C. Do not apply air/vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.

D. The product shall not be installed after the expiry date printed on the label of each container.

1.08 WARRANTY

A. Provide manufacturer's standard product warranty, for a period of 3 years from date of Substantial Completion.

B. Provide Contractor's 2-year warranty from date of Substantial Completion, including all components of the air barrier assembly, against failures, including, but not limited to, loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, and failure to cure properly.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide one of the following acceptable products:
1. "BASF"; Spraytite, Spray Polyurethane Foam Air Barrier.
2. "Icynene"; MD-C-200.
3. "Gaco Western"; Gaco Wall Foam 183M.
4. Xcelus; XLS 2000

B. Furnish auxiliary materials compatible with the air/vapor barrier.
1. Self-adhering modified asphalt/polyethylene flashing: Blueskin® by Henry Company, Inc.
2. Primer: Water based liquid primer for concrete, masonry, gypsum sheathing, wood, metal, and painted substrates: Aquatac® as manufactured by Henry Company Inc.
3. Primer: Solvent based, VOC compliant primer for concrete, masonry, gypsum sheathing, wood, metal, and painted substrates: Blueskin® Primer by Henry Company, Inc.
4. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes by SRAB air/vapor barrier manufacturer.

C. Contractor to provide 1/2" drywall thermal barrier between spray foam and finished space unless applicator/manufacturer can demonstrate compliance with NFPA 286 without the drywall thermal barrier. Where product passes NFPA 286 with a thermal ignition barrier, all costs for thermal ignition barrier, including but not limited to multiple coatings required by manufacturer, to be included in the bid.

PART 3 - EXECUTION

3.01 INSPECTION

A. Installer must examine substrate and conditions under which insulation work is to be performed and must notify Contractor in writing of unsatisfactory conditions. Do not proceed with insulation work until unsatisfactory conditions have been corrected.

B. Examine substrates, areas, and conditions under which air/vapor barrier systems will be applied, with Installer present, for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. Do not proceed with installation until after minimum concrete curing period recommended by air/vapor barrier manufacturer.

   2. Ensure that surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants; concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions; masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
   3. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
   4. Notify Architect in writing of anticipated problems using air/vapor barrier over substrate prior to proceeding.

3.02 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air/vapor barrier application.
   1. Prime masonry, concrete substrates with conditioning primer when installing modified asphalt membrane transition membranes.
   2. Prime glass-fiber surfaced gypsum sheathing an adequate number of coats to achieve required bond to transition membranes, with adequate drying time between coats.
   3. Prime wood, metal, and painted substrates with primer recommended by membrane manufacturer.

B. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air/vapor barrier and at protrusions according to air/vapor barrier manufacturer's written instructions.

C. Mask and cover adjacent areas to protect from over spray.

D. Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.

E. Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.

F. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.

G. Surfaces to receive foam insulation shall be clean, dry and properly fastened to ensure adhesion of the polyurethane foam to the substrate.

H. Ensure that all work by other trades that may penetrate through the air barrier system is in place and complete.

I. Ensure that surface preparation and any primers required conform to the manufacturers instructions.

J. Prepare surfaces by brushing, scrubbing. Scraping, or grinding to remove loose mortar, dust,

oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the spray polyurethane foam. Wipe down metal surfaces to remove release agents or other non- compatible coatings, using clean sponges or rags soaked in a solvent compatible with the spray polyurethane foam. Ensure surfaces are dry before proceeding.

K. Install transition membranes to all applicable surfaces and ensure proper adhesion of the transition membranes to the substrate, capable of having spray polyurethane foam insulation.

L. Install counter-flashings and counter-flashing membranes. All window and door openings to have counterflashing membrane.

M. Ensure veneer anchors are in place.

3.03 INSTALLATION

A. Spray-application of polyurethane foam shall be installed in accordance with ULC S705.2-02 and the manufacturers instructions. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and the ULC S705.2 Installation standard.

B. Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings. Passes shall be not less than 1⁄2 inch and not greater than 2 inches.

C. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.

D. Finished surface of foam insulation to be free of voids and embedded foreign objects.

E. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.

F. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.

G. Clean and restore surfaces soiled or damaged by work of the section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work. Do not permit adjacent work to be damaged by work of this section. Damage to work of this section caused by other sections shall be repaired by this section at the expense of the subcontractor causing the damage.

H. Complete connections to other components or repair any gaps, holes or other damage using material which conforms to ULC S710.1

I. Maximum variation from indicated thickness: minus (-) 1⁄4 inch; plus (+) 1⁄2 inch.

3.04 PROTECTION

A. Protect the spray polyurethane foam from ultraviolet radiation when installed on the exterior of a building.

B. Cover the spray polyurethane foam with a thermal barrier when installed on the interior of the building.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 07 21 19

SECTION 07 42 13 - METAL WALL PANEL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Metal wall panel assembly as indicated on Drawings and specified herein.
   1. Includes preformed sheet metal panels, related accessories, trim, corners, miscellaneous flashing and attaching devices for a complete watertight installation.

B. Metal Wall Panel systems specified herein include:
   1. Metal Wall Panel (Concealed Fasteners - Flush).

1.02 QUALITY ASSURANCE

A. American Iron and Steel Institute - AISI. “Light Gauge Cold-Formed Steel Design Manual”.

B. American Society of Testing Materials - ASTM
   A-116 Structural, Physical Quality of Galvanized Steel Sheet.
   A-525 General Requirements for Galvanized Steel Sheet.
   D-1056 Flexible Cellular Material.
   B-209 Smooth or Stucco Embossed Prefinished Aluminum.
   E-330-84 Test Method for Structural Performance by Uniform Static Air Pressure Difference.

C. SMACNA - Architectural Sheet Metal Manual.

1.03 SUBMITTALS

A. Manufacturer's Literature:
   1. Published materials description and specifications for each type panel specified.
   2. Manufacturer's installation instructions for each type panel specified.

B. Samples:
   1. 12” x 12” section of metal panel.
   2. Full size sample of clip and batten.
   3. Samples showing manufacturer's full range of colors.
      Submit additional or larger samples of selected colors upon request.

C. Shop Drawings:
   1. Detailed drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories.
   2. Show details of weatherproofing, terminations and penetrations of metal work.
   3. Show methods of installation and anchorage to accommodate thermal movement.

D. Warranty:
   1. Submit copy of manufacturer's warranty.
   2. Submit additional warranties as required by this Section.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not deliver roof materials to site until ready for installation. Comply with manufacturer’s recommendations for handling storage and protection during installation.

1.05 WARRANTY

A. Provide manufacturer’s one year guarantee against defects in materials and workmanship, as delivered.

B. Provide installers, separate two-year guarantee against defects in installed materials and workmanship, including water integrity. Guarantee shall begin with the date of Substantial Completion.

C. Provide written warranty, signed by manufacturer stating painted wall panel finish will not check, flake, peel or chip for a period of fifteen (15) years, minimum.
   1. Film will not fade, peel or crack, ASTM D-1737.
   2. Abrasion resistance: will withstand 30 liters of falling sand before appearance of base metal, ASTM D-968.
   3. No checking, blistering or adhesion loss when tested for 5000 hours per ASTM G-23-69.
   4. Hardness: F-2H per ASTM D-3363.
   5. Humidity: less than 5% #8 blisters when tested for 1000 hours per ASTM D-2247 (100% humidity at 100°F).
   6. Salt-spray: maximum 3/16" creep and less than 5 #6 blisters when tested for 1000 hours per ASTM - B117 (5% salt fog at 95°F).

D. Provide written warranty, signed by manufacturer stated painted finish will not chalk or fade for a period of ten (10) years, minimum.
   1. Maximum chalk rating of 6 as measured by ASTM D659-44.
   2. Finish will not change color more than 1 degree in excess of 6 NBS units as measured by ASTM D-2244.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Metal Wall Panel (Concealed Fasteners - Flush):
   1. Provide one of the following approved products:
      a. “Metal Sales Manufacturing Corp.”; Flush Face Series-12; #TLC-2.
      b. “Fabral Metal Wall and Roof Systems”; Architectural Commercial Siding; Select Series 12-R2.
      c. “Metecno-Morin”; Concealed Fastener Panels; #F-12-2.
      d. “Centria”; IW Series; #11-A.
      e. “Firestone Building Products Company”; UNA-CLAD UC-500.
      f. “MBCI”; Artisan Series #L12.
      g. “Pac-Clad / Petersen Aluminum Corp.”; Flush Panel 12”.
      h. “Dimensional Metals, Inc. (DMI)”; Flush Panel FP-10.
   2. Panels:
      a. Roll formed G-90 galvanized steel.
      b. 12” panel width coverage.
      c. Concealed fastened panel.
   3. Profile:
      a. 1” to 1-1/2” nominal panel height.
      b. Flush face solid surface.
      c. Two indented pencil ribs equally spaced in the width of the panel face.
   4. Fasteners:
      a. Direct fastening through fastening leg at end of panel.
      b. Screws into structure to be #10-16x1” pancake head driller screws.
      c. Fasten per manufacturer’s recommendation or at 48” o.c., minimum.
      d. Adjacent panel installed in tongue-and-groove type fashion to cover and conceal fastener.

E. Gauges:
   1. 22 gauge minimum for panels up to 20’ lengths.
   2. 20 gauge minimum for panels exceeding 20’ lengths.

F. Finish:
1. Exposed side: Kynar 500 (PVDF) with 10-year warranty.
2. Back side: Acrylic wash coat, 0.3 - 0.4 mil dry film thickness.

3. Color as indicated on the Drawings. If not indicated, to be selected from manufacturer's entire selection, including premium colors. Various manufacturer's may need to custom match a color, if a specific manufacturer's color is indicated on the Drawings or specified herein, or to match an existing product.

G. Flashing and Trim:
1. Material:
a. C-90 galvanized steel.
b. Minimum 26 gauge.
2. Finish:
a. Kynar 500 (PVDF) with 10-year warranty.
b. Color to match wall panel.
3. Anchors:
a. Stainless steel.
b. Other nonferrous or coated galvanically compatible material as recommended by the metal wall panel manufacturer and as approved by the Architect.
4. Expansion and Control Joints:
a. As recommended by metal wall panel manufacturer.
5. Length:
a. Provide lengths as indicated on the Drawings.
b. If not indicated, provide minimum 10’-0” length with 6” splice plate to allow thermal movements.

H. Foam Closure:
1. Black closed cell foam meeting ASTM D1056. Closures to be supported and protected from weathering by a metal channel matching the flashing.
2. Provide tape and sealants with an indicated service life of 20 years.
3. Provide closures and pan-ends of panels at all exposed ends and corner conditions.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine conditions under which roofing is to be installed.
Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wall panel system reversed to match existing, in accordance with manufacturer’s instructions.

B. System shall be capable of accommodating out-of-square and out-of-plumb conditions normally encountered in building construction.

C. Remove stripable, protective vinyl film immediately after installation.

SUBMITTAL CHECK LIST
1. Manufacturer's Literature.
2. Samples.
3. Shop Drawings.

4. Warranty.

END OF SECTION 07 42 13

SECTION 07 54 00.02 - THERMOPLASTIC SHEET ROOFING SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The Work generally involves a new reinforced single-ply thermoplastic PVC membrane system.

B. System Construction:
   1. Adhered System:
      a. Insulation is mechanically fastened to the deck.
      b. Tapered insulation saddles, where applicable, are mechanically fastened to the deck.
      c. Overlayment board is mechanically fastened to the deck.
         Stagger the joints of overlayment board with those of the insulation.
      d. The membrane sheet is adhered to the overlayment board. All laps sealed by heat welding.
      e. Work includes the installation of new insulation, saddles, sumps, blocking, overlayment board, roof membrane, fasteners, adhesives, copings, flashings, walkpads, sealants and all additional items necessary to complete the work and meet the manufacturer's warranty requirements for a complete system warranty.

C. The words "ply", "membrane", and "sheet" are used interchangeably, and are to be interpreted as having the same meaning.

D. Work includes the following special warranties, as specified:
   1. Water-tightness warranty from the installer.
   2. Warranty from the manufacturer for water-tightness and color.

E. Not all details and conditions are shown on the Drawings. Contractor is responsible for providing a complete, finished, and water-tight roof system warranted for water tightness from the deck up.

1.02 QUALITY ASSURANCE

A. Thermoplastic sheet roofing and flashing shall be installed only by factory-trained and manufacturer approved and licensed roofing contractors familiar with the product and in strict accordance with the manufacturer's instructions.

B. All details relating to the installation of the approved roofing contractor and/or by the manufacturer shall be installed in such a manner that the manufacturer will furnish a 15 year NDL Warranty for the installation.

C. All materials used shall be as furnished or approved by the roofing manufacturer for use and compatibility with the entire roofing system.

D. Manufacturer shall send a qualified technical representative to project site for purpose of advising Installer of procedures and precautions related to use of roofing materials.

E. UL Listing: Provide labeled materials which have been tested and listed UL for application indicated to provide a "Class A" rated materials/system.

F. Factory Mutual Listing: provide flexible sheet roofing system which is listed as approved in the FM Approval Guide and complies with the following FM classifications:
   1. "Class I" fire rating.
   2. "Classification FM I-90 wind uplift rating.

G. Conduct fastener pullout tests in accordance with the latest revision of the SPRI/ANSI Fastener Pullout Standard to help verify condition of deck/substrate and to confirm expected pullout values.

1.03 REFERENCES

A. Publications of the following institutes, associations, societies and agencies are referred to in this Section.
   1. American Society for Testing and Materials, ASTM, D-4434
   2. Underwriter's Laboratories, Inc., UL
   3. Factory Mutual Underwriters, FM
      a. Factory Mutual Research Corporation-Loss Prevention Data Sheets 1-7; 1-28; 1-28(s); 1-29; 1-30, 1-49
      b. Factory Mutual Research Corporation - (FMRC) Approval Guide - Roof Coverings.
      c. Factory Mutual Research Corporation Standard 4470 - Approval Standard for Class I Roof Covers
   4. NRCA Roofing and Waterproofing Manual.
   5. Roof Consultants Institute Glossary of Terms.
   6. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.
   7. American Society of Civil Engineers - Reference Documents ASCE 7-93, Minimum Design loads for Buildings and Other Structures.

1.04 CODE AND TEST REQUIREMENTS

A. The roof system that is bid shall have been tested in compliance with the following codes and test requirements.
   1. The roof system assembly shall have test data in compliance with test criteria set forth in Factory Mutual Test Standard 4470 to support uplift pressure resistance to design pressures calculated in compliance with ASCE 7-93.
   2. The roof system assembly shall be approved for application within the International Building Code jurisdiction.
   3. The roof system assembly shall be installed in compliance with all local building and safety requirements adopted by the local building code jurisdiction.
   4. All metal flashings shall be in compliance with recommendations set forth in Factory Mutual Research Corporation Loss Prevention Sheet 1-49.

1.05 SUBMITTALS

A. Submit the following in compliance with contract conditions and Division 1 Specification Section.
   1. Confirmation of Manufacturer and Applicator requirements enumerated in this Section.
   2. Samples:
      a. 12" x 12" square sample of each type of membrane.
      b. All roof insulation types and overlayment used.
      c. Flashing materials.
      d. All fastener types used.
   3. Submit (2) copies of the manufacturer's current published installation instructions, flashing and roofing specifications, Product Data Sheets for all products, and Material Safety Data Sheets for all products used in the assembly of the roof system.
   4. Manufacturer's complete recommended maintenance procedures for roofing system, including precautions and warnings to prevent damage to, and deterioration of roofing system, and any safety precautions published by the roof system manufacturer.
   5. Shop Drawings:
      a. Provide complete installation details of roofing, flashing, fastening and insulation, including notation of roof slopes and fastening patterns of insulation and membrane. Shop drawings to include (but not limited to):

1) Outline of roof with roof size and elevations shown.
2) Profile details of flashing methods for all conditions and penetrations.
3) Technical acceptance from roof membrane manufacturer.

6. Certificates:
   a. Manufacturer's written approval of:
      1) The roof system to be applied over the submitted insulation and deck type; coping system
      2) Contract documents;
      3) Applicator and;
      4) Warranty conditions specified. Submit certification letter acknowledging receipt of specifications, intent to issue warranty, and intent to perform specified field inspections.
   b. Insulation manufacturer's certification that the product is compatible with the proposed roof system and meets specification requirements.
   c. Manufacturer's field reports from field inspections.
   d. At completion of roof application, the contractor and membrane manufacturer shall supply the owner and/or architect with a complete set of as-built drawings.
   e. Certification from the membrane manufacturer at job completion confirming the installed roof assembly is in compliance with the approved submittals.

1.06 QUALIFICATIONS

A. Applicator's Qualifications:
   1. **All roofing contractors/installers must be pre-qualified to bid, by both the manufacturer and the Architect, at least seven days prior to the bid date.**
   2. For purposes of quality assurance and performance with specified roof system installation, all bidders are to be approved by the manufacturer, and listed as approved by the Architect, prior to the bid date and throughout the installation, and able to present a copy of current certification status upon request by the Architect or Owner.
   3. Contractor must have experience in installing the specified roof system and be able to produce a list of referenced projects to visit.
   4. Maintain a full-time supervisor/foreman experienced with the specified roof system on-site when roof system application is in progress. Certification of general experience and experience with specified roof system shall be included in the submittal.
   5. Be equipped with a trained crew and all capital equipment required to perform work of this section.
      a. Maintain all equipment and tools in good working order.
      b. Provide, in writing, safety plan and equipment to the work force and specify, proper clothing.
   6. Contractors not already pre-qualified in this Specification, and wishing approval to be qualified to bid, shall submit qualifications and certifications in writing to the Architect for written approval prior to bid.

B. **Pre-Qualified Installers:**
   1. **American Roofing**
      4610 Roofing Rd.; Louisville, KY 40218
      (502) 966-2900; (502) 966-2970 fax
   2. **Bruce's Tri-State Roofing & Sheet Metal Co.**
      320 East 14th Street; Owensboro, KY 42303
      (270) 683-0610; (270) 683-3508 fax
   3. **Blackmore and Buckner Roofing**
      1256 East Roosevelt Avenue, Indianapolis, IN 46202
      (317) 263-0707; (317) 263-0727 fax
   4. **Concord Roofing, LLC**
      310 Floyds Fork Drive, Shepherdsville, KY 40165
      (502) 957-6063; (502) 957-7715 fax
   5. **Geoghegan Roofing Corporation**

1405 Garland Avenue; Louisville, KY 40210
(502) 585-4313; (502) 585-5494 fax

6. **Hedinger Roofing**
   2803 Market Street; Jasper, IN
   (812) 482-5066
7. **Henry C. Smither Roofing**
   6850 E. 32nd Street; Indianapolis, IN 46226
   (317) 545-1304; (317) 546-4764 fax
8. **HRC Roofing & Sheet Metal**
   2845 Roadway Drive, Columbus, IN 47202
   (812) 372-8409, (812)-372-6836 fax
9. **Industrial Contractors, Inc.**
   401 N.W. First Street; Evansville, IN 47708
   (812) 464-7270; (812) 464-7399 fax
10. **Lehman Roofing, Inc.**
    2728 Mt. Vernon Avenue; Evansville, IN 47712
    (812) 426-1111; (812) 426-1114 fax
11. **Midwest Roofing and Sheet Metal, Inc.**
    1208 North Harlan Avenue; Evansville, IN 47711
    (812) 423-1138; (812) 423-7255 fax
12. **R. Adams Roofing**
    4990 Massachusetts Ave.; Indianapolis, IN 46218
    (317) 545-7663
13. **Roofing Services and Solutions, LLC (RSS)**
    1508 Fabricon Boulevard; Jeffersonville, IN 47130
    (812) 283-4490; (812) 283-6412 fax
14. **The Zero Company**
    4045 McCollum Court; Louisville, KY
    (502) 456-5848; (502) 456-5906 fax

C. Manufacturer's Qualifications:
   1. Must have a minimum of 20-year experience manufacturing elastomeric roofing membranes.
   2. Provide a factory-trained technician to attend site meetings, interim inspections, and to perform final inspections of the roofing system.
   3. Provide a warranty upon satisfactory installation of the roofing system.

1.07 PRE-INSTALLATION CONFERENCE

A. Convene less than five days prior to commencing work of this section at the jobsite, and at a time to be determined by the architect, contractor, manufacturer's field representative, and the owner.
   1. All parties responsible for work of this section are required to attend including the Architect, Contractor and any other trades involved in the roofing work.
   2. Review installation procedures and coordination required with related work.
      a. Tour, inspect and discuss condition of substrate, roof drains, roof drain final locations, curbs, penetrations and other preparatory work performed by other trades.
      b. Review structural loading limitations of deck and inspect deck for loss of flatness and for required mechanical fastening.
      c. Review roofing system requirements (Drawings, Specifications, Submittals and any other Contract Documents.)
      d. Review required submittals, both completed and yet to be completed.

e. Review and finalize construction schedule related to roofing work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
f. Review requirements for Manufacturer's Roofing Quality Control Inspector inspections, other inspections, testing, certifying, and material usage accounting procedures.
g. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions, including possibility of temporary roofing.

3. Inspect and make notes of job conditions prior to installation.
   a. Minutes shall be taken at the conference and provided to all parties present.
   b. All outstanding issues shall be noted in writing designating the responsible party for follow-up action and the timetable for completion.
   c. Application of roofing system will not take place until all outstanding issues are completed.

   d. Acceptable staging areas; suitable parking and access points; placement of trash conveyances; sanitary requirements; and all working hour restrictions (day/night, weekends, holidays); noise restrictions and project complaint procedure between contractor and building owner (occupants).
4. If conditions are not satisfactory, and an additional conference is required, Contractor shall bear the transportation expenses for all parties to attend second conference.

1.08 DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries to provide sufficient quantities to permit continuity of any phase of work.

B. Do not store material on roof construction in concentrations large enough to impose excessive stress on decking or structural members. No stockpiling of materials on the roofs will be permitted. Materials will be raised onto roof in limited quantities only as needed for immediate work.

C. Membrane shall be stacked and protected from moisture penetrating the ends.

D. Deliver all materials and store in their unopened original packaging, bearing and manufacturer's name, related standards and any other specification or reference accepted as standard.
   1. When stored outdoors, insulation is to be stacked on pallets or dunnage at least four (4) inches above ground level and covered with "non-sweating" tarpaulins. Factory shrink wrapping is not sufficient protection for insulation.

   2. Store membrane rolls lying down on pallets and fully protected from the weather with clean canvas tarpaulins. Unvented polyethelene tarpaulins are not acceptable due to the accumulation of moisture beneath the tarpaulin in certain weather conditions that may affect the ease of membrane weldability.

E. Protect and permanently store all materials in a dry, well-vented and weatherproof location. Only materials to be used the same day shall be removed from this location. During winter, store materials in a heated location with a 50°F. minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.

F. Carefully store on end materials delivered in rolls with salvage edges up, a minimum of 6 inches above grade. Store metal flashings and counterflashings in such a way as to prevent wrinkling, twisting, scratching and other damage.

G. Adhesive storage must be between the range of above 40°F and below 80°F. Area of storage shall be suitable for flammable storage.

H. All materials determined to be damaged shall be removed from job site and replaced at no cost to Owner. Any insulation which becomes wet must be removed from the jobsite. Any insulation which experiences condensation under the factory shrink wrapping must be removed from the jobsite.

1.09 MANUFACTURER CERTIFICATIONS AND INSPECTIONS

A. Submit certification by the manufacturer of the system materials used that these Specifications and the Drawing Details are acceptable to them for the deck and surfacing to which they are to be applied.
   1. If details for any manufacturer's systems proposed in the Contract Documents are not acceptable to the manufacturer, submit corresponding details proposed for the particular application, together with the manufacturer's reasons for not accepting the conditions depicted in the Specifications or Drawings. No alternate details will be considered without evidence of valid objections on the part of the manufacturer to the Contract requirements prior to bid due date.
   2. No deviation is to be made from this Specification without prior written approval by the manufacturer and the Architect.
   3. Submit certification signed by membrane manufacturer's quality control manager that polymer thickness is as specified.

B. Inspection: Prior to, at least twice during installation, and at completion of the installation, an inspection shall be made by a representative of the manufacturer in order to ascertain that the roofing system has been installed according to their published specifications, standards and details.
   1. Warranty will be issued upon approval of the installation (see 1.11 of this Section).
   2. Copies of manufacturer's inspection reports shall be submitted directly to the Architect, and to the Owner within ten days of the inspection.
   3. Perform additional inspections at no additional cost, as required to accommodate phasing of the work, partial installations, and as otherwise requested by the Architect to address quality control issues.

1.10 WARRANTY

A. Upon completion of work, furnish to the Owner the manufacturer's written and signed standard warranty, certifying the performance of his products and the consistency of the properties of such products affecting their performance for a period of 15 years from date of acceptance.

B. The Contractor is to cover damages to the building resulting from failure to prevent penetration of water during construction.

C. The Contractor is to guarantee all work against defects in materials and workmanship for a period of one year following final acceptance of the Work.

D. Warranty shall be an "NDL" (No Dollar Limit Warranty) covering the materials and labor for complete roof system. The Warranty shall not be pro-rated over the term of the warranty and shall not be limited to the original installation cost. Roof system is defined as insulation, overlayment, roof membrane, flashings, coping, counter flashing, termination bars, boots, penetrations, primer, scuppers, roof drain pans, crickets, saddles, fasteners, and all other roofing components needed to create a water tight barrier above the metal deck.

E. Include the following items within Warranty:
   1. Roofing inspection by Manufacturer's Roofing Quality Control Inspector within 24 months after date of Final Acceptance.
   2. Roofing manufacturer will provide unlimited repairs during warranty period with no cost limitation.
   3. Temporary emergency repairs may be made by Owner without voiding any warranty provisions.
   4. Attach copy of Record Document Roof Plan Drawings, Roof Detail Drawings, and Record Modified Bituminous Membrane Roofing Specification Section to Warranty.
   5. Warranty shall cover wind gusts up to 72 miles per hour (sustained), and 90 mph-3 second

gust.

6. Meet the specified FM classification as identified in the Quality Assurance section in Part 1 of this specification.
7. Colorfastness: no significant change in the color of the membrane during the Warranty period.

1.11 JOB CONDITIONS

A. Proceed with roofing work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer's recommendations and warranty requirements. All surfaces to receive insulation, membrane or flashings must be dry.

B. During roofing work, exposed unfinished surfaces shall be protected with tarps in order to prevent damage. Contractor shall assume full responsibility for any damage. Protect existing building and completed areas of new additions from all risks of damage from inclement weather.

C. Do not install membrane under the following conditions:
   1. The roof assembly permits interior air to pressurize the membrane underside.
   2. Any exterior wall has 10% or more of the surface area comprised of open doors or windows or unfinished wall enclosures.
   3. The wall/deck intersection permits air entry into the wall flashing area.

D. Install uninterrupted waterstops at the end of each day's work and completely remove waterstops before proceeding with next day's work. Waterstops shall not emit dangerous or unsafe fumes and shall not remain in contact with the finished roof as installation progresses. Replace contaminated membranes at no cost to Owner.

E. Do not use asphalt, coal tar, heavy oils, roofing cement, creosote or preservatives.

F. Arrange work sequence to avoid using newly constructed roofing as a walking surface or for equipment movement and storage. Where such access is unavoidable, provide all necessary protection and barriers to segregate work area to prevent damage to adjacent areas and provide plywood protection boards.

G. Remove all dirt, debris, and dust from all surfaces prior to and during application.

H. Comply with all safety regulations of authorities having jurisdiction.

I. All material removed during construction and all waste materials to be immediately removed and legally disposed of off site.

J. Do not overload the roof deck or building structure.

K. Keep all solvents, flammable adhesives and deck primers away from open flames, sparks and excessive heat. Keep lids closed at all times on all unused cans. Keep solvents adhesives and primers away from air intake vents. Prevent adhesive odors from entering building.

L. Verify that all roof drain lines are functioning correctly before beginning work. Report any blockages to Architect.

M. Repair all damage to existing building and grounds caused by construction work at no cost to Owner.

N. Wear proper clothing and protective gear at all times.

O. Visit the site prior to bidding and carefully examine all existing areas and conditions that may affect proper execution of the work. No claims for extra costs will be allowed because of lack of full knowledge of the existing conditions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. "Sarnafil Roofing Systems"
(800) 532-5123

2.02 ROOF MEMBRANE SYSTEMS

A. Thermoplastic Membrane Roofing Sheet:
1. Adhered System:
a. Provide one of the following acceptable products:
1) "Sarnafil", G410.
b. Description:
1) Certified minimum membrane thickness: as required for specified warranty, but not less than 0.060".
2) Color: As indicated on the Drawing or specified herein.
If not indicated, color to be selected from manufacturer's entire standard selection.
3) Polyester reinforced.

3. Sarnaclad (also referred to as "Sarnaclad Metal")
a. 25 gauge, G90 galvanized metal sheet with 20 mil unsupported Sarnafil membrane laminated on one side.
b. Use where directed by the manufacturer to replace metal otherwise shown on the drawings.
c. Color: To be selected by Architect from manufacturer's entire selection.

B. Coping:
1. Pre-manufactured copings at roof edge shall be heavy duty prefabricated perimeter edge attachment and fascia assembly provided by Sarnafil.
2. Anchor bar of 0.125" extruded aluminum 6063-T6 alloy, in 12 foot lengths with pre-drilled fastening holes. Snap-on fascia covers of .050" aluminum with Kynar finish.
3. 6" vertical outside face.
4. 8" wide concealed splice plates with dual non-curing sealant strips. Color to match fascia.
5. #12 x 1-5/8" corrosion resistant fasteners. No exposed fasteners permitted.
6. Color: To be selected by Architect from manufacturer's entire selection.

C. Flashing Membranes:
1. Generally the same material as the roofing membrane.
2. Manufacturers may vary reinforcing material from field sheets in flashing membranes in order to address various field conditions.

D. Bonding Adhesive for Membrane, Flashing and Accessories:
1. Compatible with materials to which membrane is to be bonded, and as recommended by membrane manufacturer.
a. Sarnacol 2170 solvent-based adhesive
b. Sarnacol 2121 water based adhesive
2. Formulated to withstand minimum 90 psf uplift force.

E. Sheet Seaming System:

1. Manufacturer's standard materials for hot air welding lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane manufacturer.

F. Termination Bars and Flashing Accessories:
1. Types recommended by membrane manufacturer provided at locations indicated and at locations recommended by manufacturer, and including adhesive tapes, flashing cements, and sealants.
2. Refer to Section 07 60 00 - Flashing, Sheet Metal, and Roof Accessories for any items not specified in this section, or otherwise provided by membrane manufacturer (even if not specifically identified in this section).
3. All accessories must be approved by membrane manufacturer for coverage under manufacturer's warranty.
4. Sarnaflash: prefabricated expansion joint cover.
5. Sarnareglet: extruded aluminum flashing termination reglet, 6063-T5, 0.12" thick x 2-1/4" deep. with prefabricated mitered inside and outside corners.
6. Sarnafiller: Two component urethane sealant for pitch pocket topping.
7. Sarnafelt: Non-woven polyester or polypropylene mat cushion layer for use where flashing substrates are rough-surfaced or incompatible with flashing membrane.
8. Sarnastop: 1/8" x 1" wide low profile aluminum bar.
9. Sarnabar: FM approved roll-formed stainless steel bar.
10. Sarnacord: 5/32" diameter flexible thermoplastic extrusion for use at expansion joints.

G. Walkpads:
1. Sarnatread 96 mil walkway pads with weldable membrane and surface embossment.

2. Provide as indicated on Drawings. If not indicated, provide around roof hatch, under satellite dish legs, around all rooftop equipment, at the bottom and tops of all rooftop ladders, whether or not indicated on Drawings. Provide additional walkpads for access between rooftop equipment as indicated on Drawings.

H. Preformed Accessories:
1. Provide preformed corners at all inside corners, and outside corners.
2. Provide pre-formed boots for pipe flashings. Do not use cut pieces of membrane for these conditions.
3. Sarnastack: prefabricated vent pipe flashing, 48 mil G410 membrane – color to match field membrane. Size as required.
4. Sarnadrain-RAC: PVC coated aluminum roof drain insert mechanically sealed to drainpipe interior.
5. Sarnacircle-"G": G410 membrane patch for T-joints.
6. Sarnacorner: Prefabricated ouside and inside flashing corners. 60 mil. Size as required.

I. Overnite tie-in sealants as recommended by manufacturer, but in no instance is hot asphalt permitted.

2.03 FASTENERS

A. Fastening systems shall use fasteners approved for use by the membrane manufacturer, designed metal and wood decks, and for adhesion of flashing to the substrates encountered.

B. Insulation and Overlayment:
1. Mechanical fasteners with fastener plates to secure insulation to decking shall be approved by the insulation manufacturer for the system specified.
2. The same brand fastener is to be used throughout the work.

3. Number of fasteners and layout will be recommended by the manufacturer and as required per FM Approval Guide to meet the specified FM classification for wind uplift rating. Install additional fasteners as directed in the field by the Architect.
4. Length of fastener shall be determined by the thickness of the decking and may vary with the thickness of the insulation. Fasteners shall be appropriate lengths to achieve a minimum of 1" penetration. Contractors shall ensure that fasteners do not penetrate roof deck to exposed interior.
5. The fastener and plate shall be used in all areas for attachment of the membrane. The length of the fastener shall be determined by the thickness of the insulation allowing for a 1" penetration into the deck, or as otherwise determined by the membrane manufacturer, but not less than 1".

2.04 WOOD BLOCKING AND SHEATHING

A. All nailers and blocking material to be free of wane, shake, decay or checks, and pressure treated with water-borne preservatives for above ground use, AWPB LB-2.
   1. Blocking shall not be less than Construction Grade, Southern Pine, max. 19% moisture content.
   2. Provide manufacturer's recommended protection between blocking for equipment, piping, and conduit supports above roof. Provide solid wood blocking as required for fastening and terminating membrane and flashing system. Install at the perimeter of the entire roof and around other roof projections and penetrations. Thickness of nailers must match the insulation thickness to achieve smooth transition.

B. Plywood to be minimum 1/2 inch thick CDX (C side out), smooth surfaced, exterior grade, with exterior grade glues. Provide where indicated on Drawings. Whether indicated on Drawings or not, provide at all existing masonry and concrete walls where membrane is installed and at all other locations required by manufacturer. Prime all plywood prior to membrane installation.

2.05 ROOF INSULATION

A. Sarnatherm Polyisocyanurate Board Insulation: Rigid cellular thermal insulation with glass-fiber reinforced polyisocyanurate closed-cell foam core and asphalt/glass fiber felt facing laminated to both sides; complying with Federal Specification HH-I-1972/2; aged R-value of 5.56 at 75°F respectively.

B. Mechanical Anchors: As recommended by insulation manufacturer for deck type, and complying with fire and insurance requirements.

C. Adhesive Anchoring: Where required, use high velocity insulation adhesive as recommended by membrane manufacturer and meeting the specified FM classification for wind uplift rating.

D. Verify insulation furnished is compatible with and suitable for the specified roofing system, including roofing condition, installation procedures and type of membrane to be used.

E. Insulation is to be installed in two staggered layers of 2" thick boards with a total thickness of 4" (not including tapered saddles).

F. Saddles and Crickets:
   1. Tapered polyisocyanurate board.
   2. Supplied and warranted by roof membrane manufacturer.
   3. Satisfies UL and FM test requirements and roof membrane manufacturers requirements for installation and warranty.

2.06 OVERLAYMENT BOARD

A. Provide one of the following products, pending compliance with the manufacturer's warranty:
   1. "Georgia Pacific", "Dens Deck".
   2. "Firestone", "Coverdeck 250".
   3. "Firestone", "IsoGard HD Coverboard".

B. Description of Acceptable Types:
   1. Siliconized gypsum, fire tested hardboard with heat cured glass-mat facers; 1/4" thick.
   2. High-density, closed-cell oolyisocyanurate foam core with a coated glass facing sheet; 1/2" thick.

PART 3 - EXECUTION

3.01 PREPARATION

A. Before commencing work, the Owner's representative, together with the roofing contractor and manufacturer field supervisor shall inspect and approve the deck condition (slopes and nailing supports if applicable) as well as verticals on parapet walls, roof drains, stack vents, vent outlets and others, building joints, etc. If applicable, a non-compliance notice shall be submitted to the contractor so that adjustments can be made. Commencement of work shall imply acceptance of surfaces and conditions, and responsibility for correcting unsuitable encountered at no additional cost to the Owner. Standing water shall be removed from the area prior to starting roof work.

B. Before commencing work, all surfaces shall be smooth, clean, dry and free of any debris that would adversely effect the installation of the membrane.

C. All roof penetrations shall be made prior to installation of the roofing membrane. Verify that the work of other trades has been properly completed.

D. Prevent compounds from entering and clogging drains and conductors, and from spilling or migrating onto surfaces or other work.

E. Environmental Requirements:
   1. Do not work in rain, snow, or in presence of water.
   2. Roofing installation may continue in cold weather provided adhesives and sealants are stored at room temperature and used within a 4 hour period after being exposed to lower temperatures.
   3. Remove any work exposed to freezing.

3.02 SURFACE PREPARATION

A. Clean all debris.
   1. Replace damaged or defective areas prior to commencement of work under this section.
   2. Protect adjacent building surfaces and equipment from damage.

B Maintain all equipment and tools in good working order.

3.03 INSULATION APPLICATION

A. Install roof insulation in two layers, with joints staggered. Install and fasten at a rate to meet specified uplift requirements. Fasteners must meet an average pullout of 300 lbs. No gaps between boards, nailers and penetrations greater than 1/8 inch permitted.

B. Do not install insulation which has been allowed to become wet, or has had any contact with water. Remove all insulation which becomes wet. Remove broken, delaminated and damaged insulation.

C. Install tapered insulation around all roof drains at least 3'-0" x 3'-0" wide to create a drain sump.

D. Install insulation and Dens Deck at all curbs. Coordinate with other trades as required.

3.04 INSTALLATION

A. All membrane installation is to be in strict accordance with the manufacturer's instructions. Install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer.

B. For adhered membranes, apply adhesive according to manufacturer's instructions. Use solvent based adhesive except where local ordinances prohibit use. Do not use solvents where fumes can migrate into existing building. If occupants of existing building or people nearby the project complain about solvent odor, discontinue use and use water based adhesive.

C. Hot Air Welding of Seams:
1. Clean all seams and hot air weld to exposed sheet edges as recommended by manufacturer.
2. All seams must be hot-air welded.
3. Welding equipment must be approved by membrane manufacturer.
4. All welding mechanics must complete factory training course provided by membrane manufacturer.
5. Provide portable generators or temporary electric service for welding equipment. Do not use electrical power supply on existing building without written permission from Owner and Architect. Comply with all codes for electric supply, grounding, and overcurrent protection.
6. Check all welded seams for continuity using a rounded screwdriver. On-site evaluation of welded seams to be made daily by the Contractor at locations as directed by the Architect, the Owner's Representative, or the membrane manufacturer. One-inch wide cross section samples of welded seams shall be taken at least three times a day. Correct welds which display failure from shearing of the membrane prior to separation of the weld. Patch all test cuts.

D. Install mechanical fasteners, flashings and counter-flashings and accessories at locations shown on the drawings and as recommended by manufacturer.

E. Flashing:
1. Install all flashing concurrently with the roof membrane as the job progresses. Do not use temporary flashing unless approved in writing by Architect and membrane manufacturer. Remove and replace any materials which become wet as a result of improper or inadequate coverage of roof with membrane and permanent flashing.
2. Adhere flashing in accordance with manufacturer's instructions, and paragraph B., above.
3. Do not apply adhesive in seam areas which are to be welded.
4. Install transition material at base of all transitions, peaks and valleys as required by manufacturer.
5. Extend all flashing a minimum of 8 inches above roofing level, unless approved in writing by manufacturer and Architect.
6. Mechanically fasten all flashing membranes along the counter flashed top edge. Provide termination bar, sealant, and counterflashing at all terminations.
7. Install metal copings in accordance with manufacturer's instructions. Any cut edges of metal are to be neat, straight, and at right angles. Paint exposed metal at cut edges with paint to match factory finish.

F. Walkpads:
1. Install walkpads according to manufacturer's instructions.
2. Pads to be installed straight, even, and in line with building walls.
3. Turns are to be at right angles.

3.06 WATER CUT-OFF

A. At the end of the day's work, and when precipitation is eminent, a water cut-off shall be constructed at all open edges. Construct the cut-off with the same membrane that is used for the roofing system. Cut-off must be able to withstand extended periods of wet weather. The water cut-off shall be completely removed prior to resuming the installation of the roofing system. Hot asphalt cut-offs are not permitted.

B. Remove all membrane and insulation damaged by waterstop installation, or infiltration of water around waterstop, prior to resuming work.

C. If inclement weather occurs while a temporary waterstop is in place, monitor the situation as necessary to maintain a watertight condition.

D. If any water is allowed to enter under the newly completed roofing, remove and replace the affected area and repair all damage at no additional cost to Owner.

3.07 CLEAN UP

A. Clean up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations. Do not allow any material into roof drains, gutters and downspouts.

B. Remove markings from finished surfaces.

C. Repair or replace defaced or defigured finishes caused by work of this section.

D. Contractor is to wash the entire roof membrane with a light powerwash immediately following completion of the membrane installation. Repeat process as required throughout the construction process to keep white and light membrane and reflectivity as intended by the use of the product. Contractor is to assure removal of all debris, markings, adhesive, footprints, dirt, mud and other marrings and defamation of the membrane surface. Acceptability to be determined by the Architect.

3.08 PROTECTION

A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs, structures, vehicles and utilities.

B. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch thick.

3.09 FIELD CONTROL

A. Field inspection will be performed as outlined under 1.10 of this section.

B. Correct all punchlist items from Architect and Manufacturer's Field Representative prior to demobilization from the project.

END OF SECTION 07 54 00.02

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The extent of each type of flashing and sheet metal work is indicated on the drawings and by provisions of this section.

B. The types of work specified in this section include, but are not limited to, the following:
   1. Metal edge flashing and coping.
   2. Metal wall flashing and expansion joint.
   3. Exposed metal trim/fascia units.
   4. Miscellaneous sheet metal accessories.
   5. Metal gutters.
   6. Metal downspouts.
   7. Sheet metal flashing at windows and exterior doors.

C. Gutters and downspouts may be either aluminum or galvanized steel as approved by the Architect. The intent is that all metal work shall have the same and consistent finish so as to appear as a cohesive installation. Coordinate with coping, fascia, soffits, flashings, trim, etc.

1.02 QUALITY ASSURANCE

A. Sheet metal flashing and trim shall conform with recommended practices contained in "Architectural Sheet Metal Manual", Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).

1.03 SUBMITTALS

A. Shop Drawings:
   Show typical details of formed configuration, seams, joints, thicknesses, dimensions, fastening and anchoring methods.

B. Samples:
   1. 6 inch x 6 inch piece of metal and each type fastener.
   2. Colors to be selected from manufacturer's entire standard selection.

1.04 JOB CONDITIONS

A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Insure best possible weather resistance and durability of the work and protection of materials and finishes.

B. Do not proceed with the installation of flashing and sheet metal work until curb and substrate construction, cant strips, blocking and other construction to receive the work is completed.

1.05 WARRANTY

A. The Project warranty provided by the Contractor shall include agreeing to repair or replace sheet metal and flashing which has failed to fulfill performance requirements of waterproofing due to defective materials, workmanship or improper installation, during the warranty period.

1.06 FINISHES

A. As shown on the Drawings or as selected from manufacturer's entire selection.

B. All colors and finishes are to be as selected by Architect.

C. Custom color may be required to produce a match to that selected or to match existing building materials.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless Steel:
1. ASTM A 167, soft temper, Type 304.
2. 26 gauge (.018 inches) sheet.
3. Finish 2D, dull; ASTM A 480.

B. Galvanized Steel:
1. ASTM A 525, coating G90.
2. Thickness (minimum):
a. 18 gauge.
b. 26 gauge flashing.
c. 24 gauge gutters.
d. 22 gauge, downspouts.

C. Aluminum:
1. ASTM B 209, Alloy 5005-H134.
2. Thickness (minimum):
a. .032 inches, or as otherwise indicated on Drawings.
b. .032 inches, gutters.
c. .032 inches, downspouts.
3. Finish: Fluoropolymer enamel.

D. Copper:
1. ASTM B 370, cold rolled sheet.
2. Weight: 16 oz.

E. Lead Coated Copper:
1. ASTM B 101, Class A, cold rolled sheet.
2. Weight: 16 oz.

F. Solder:
1. ASTM B 32.
2. 50-50 Block tin and pig lead; 40-60 lea and tin for lead coated copper.

G. Fasteners:
1. Stainless Steel nails, flat-head.
2. Galvanized steel, hot dipped, flat head.
3. Hard copper, brass or bronze, flat-head, 12 gauge for copper and lead coated copper.

H. Cleats:
1. 2 inches wide, 3 inches long piece of sheet metal.
2. 16 oz., unless otherwise specified.

I. Flux:
1. Rosin or muriatic acid neutralized with zinc.

J. Bituminous Paint:

1. Asphalt emulsion, ASTM D 1187, Type A.

K. Sealant:
1. One-part butyl rubber sealant, FS TT-S-00657, Type 1.

L. Metal Accessories:
1. Provide sheet metal clips, straps, anchoring devices and similar accessory units as required for installation of work, matching or compatible with material being installed, non-corrosive, size and gauge required for performance.

M. Coil Stock:
1. “Alcoa Aluminum” with Almalure 2000, 2-coat acrylic topcoat resin.

2.02 FABRICATION

A. Form metal flashing and trim to configurations indicated on the Drawings, free from defects which impair strength or mar appearance.

B. Remove acid flux residue by neutralizing and scrubbing with ammonia or washing with soda solution. Rinse with clean water.

C. Tin edges of plain copper sheets to be soldered for a width of 1-1/2 inches both sides with solder.

D. Seams:
1. Make seam in direction of flow.
2. Seams must be soldered or locked, unless otherwise approved.
3. Gutter and downspout seams may be lapped.
4. Standing seams shall finish not less than 1” high unless otherwise specified.
5. Flat-Lock Seams, Soldered and unsoldered: Finish not less than 3/4” wide.
6. Lap Seams, Soldered: Finish not less than 1” wide.
7. Lap Seams, Unsoldered: Overlap 3" unless otherwise noted.
8. Loose-Lock Seams, Unsoldered: 3” common, or hook, seam, filled with sealant.

E. All exposed edges not seamed shall be hemmed, bent back 1/2 inch to unexposed side.

F. Furnish edge strips where sheet metal extends over edges and where necessary to secure sheet metal work at fascia, gravel stops, etc. Form edge strips of compatible material.

PART 3 - EXECUTION

3.01 GENERAL

A. Examine all surfaces to receive the metal flashing and trim. Verify all dimensions of in-place and subsequent construction. Installation of metal flashing and trim constitutes acceptance of the existing conditions.

B. Surfaces to which sheet metal is to be applied shall be smooth, sound, clean, dry and free from defects that might affect the application.

C. Erect all member plumb, level and in line securely anchored and properly related to other parts of the Work.

D. Protect metal surfaces which are to be in contact with dissimilar metals, with wood or other absorptive material, with roofing felt, building paper or a coat of bituminous paint specified to prevent galvanic or corrosive action. Protection shall not extend onto exposed surfaces.

3.02 INSTALLATION

A. Base Flashing:
1. On roofing where shown, extend flashing up vertical surfaces not less than 8 inches unless otherwise shown, and 4 inches horizontally out on the roof.

B. Insert Flashing:
1. Preform, interlock and bed insert flashing, extend horizontally from face of wall to backing, extend vertically and insert in reglet: Secure as hereinafter specified.

C. Counterflashing:
1. Overlap base flashing 4 inches.

D. Securing Flashing and Reglets:
1. Open Slot Reglets:
a. Turn sheet metal into open slot reglets and secure with lead or copper plugs at approximately 12 inches o.c.
2. Friction Type Reglets:
a. Turn sheet metal into friction type reglets and secure by indenting slot 12 inches o.c. with a dull punch or by means of “thumbnail” notches in sheet metal at 12 inches o.c.

E. Cleats:
1. Where required to retain flashing, provide cleats specified, spaced not more than 12 inches o.c. Secure one end with two nails and fold clip back over nail heads. Lock free end of cleat into seam or into folded edge of sheet metal.

F. Roof Penetration Flashing:
1. Base Flashing:
a. Extend flange onto roof 6 inches minimum away from penetration.
b. Extent Flange upward around penetration to at least 2 inches above floor line.
c. Fold back upper an side roof flange edges 1/2 inch minimum.
d. Solder lap joints.
2. Counterflashing:
a. Provide sealant around penetrations through flashing.

G. Reglets:
1. Install in accurate location, straight in-line, with leakproof joints.

H. Drip Edge:
1. Extend 4 inches wide up from eave edge full eave length.
2. Set into asphalt flashing cement, full width.
3. Secure with aluminum annular ring nails 12 inches o.c.

I. Base Flashing at shingle roof slope along vertical surface:
1. Extend up vertical surface 8 inches minimum and onto roofing 4 inches minimum.
2. Solder lap vertical seams; miter and solder lap corners.
3. At sloped roof extend flashing from 2 inches above top edge to base shingle to 1-1/2 inches above butt edge of covering edge of shingle, extending 5 inches up vertical surface.
4. Install flashing under each shingle course.

J. Apron flashing at roof sloping away from vertical surface:
1. Extend up vertical surface to first masonry joint (if applicable), and onto roofing minimum 4 inches.
2. Hem bottom edge 1/2 inch.
3. Lap seam vertical joints minimum 3 inches and apply sealant engaging hemmed edged.
4. Miter and solder joints: extend minimum 3 inches around corners.
5. Install bottom edge tight against roofing.
6. Counter flash top edge.

K. Cricket Flashing:
1. Form to slope away from vertical surface.
2. Extend up vertical surface minimum 4 inches and 8 inches onto roof surface, with edges folded back 1/2 inch.
3. Solder lap joints: cleat to substrate.

L. Rake Flashing:
1. Extend horizontal flange 3 inches under roofing and nail to substrate.
2. Extend vertical face of fascia.
3. Lap seam joint in direction of flow.

M. Gutters:
1. 6", box (A-Style) profile, unless otherwise indicated.
2. Continuous 10’-0” lengths with 6” splice plate to allow thermal movements.
3. Lap joints 1 inch minimum and rivet.
4. Fabricate outer edge 1/2 inch minimum lower than back edge.
5. Stiffen outer edge with hemmed return.
6. Secure end caps with 1 inch minimum width flanges riveted and sealed.
7. Secure gutter with matching metal straps spaced 2 feet apart maximum.
8. Locate and shape outlet thimble to fit downspouts and extend 2 inches below gutter soffit.
9. Rivet and seal thimble flanges to gutter bottom.

N. Downspouts:
1. 3" x 4", plain rectangular profile, unless otherwise indicated.
2. Form with flat sheet material, plain rectangular size indicated.
3. Fabricate longitudinal joints with flat lock seams.
4. Telescope upper sections onto lower sections 1-1/2 inches minimum.
5. Rivet and solder.
6. Attach to wall with 1 inch wide straps matching downspout material, 1 gauge heavier.
7. Locate straps at downspout tops, bottoms, and at 10 feet maximum centers.
8. Secure straps to wall with fastener heads covered with strap tabs.
9. Fit strainers tightly in each downspout.

3.03 CLEANING AND PROTECTION

A. Remove all flux, scraps and dirt as work progresses. Neutralize excess flux with a 5 to 10 percent solution of washing soda and surface drenched with clean water.

B. Protect flashing and sheet metal work during construction to insure that work will be without damage or deterioration, other than natural weathering, at time of substantial completion.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Samples.

END OF SECTION 07 62 00

SECTION 07 92 00 - JOINT SEALERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The extent of each form and type of joint sealer as indicated on the Drawings and specified herein.

B. Types of joint sealants specified herein include:
1. Elastomeric Sealants.
2. Non-Elastomeric Sealants and Caulking Compounds.

C. In general, all joints are to have joint sealers, including but not limited to the following:
1. Sidewalk Joints.
2. Expansion and control joints.
3. Flashing and coping joints.
4. Interior wall/ceiling/door/window frame joints.
5. Joints between dissimilar materials.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Division 3 - concrete surfaces.

B. Refer to Division 8 - sections for glazing requirements.

C. Refer to sections of Division 22, 23 and 26 for joint sealers in mechanical and electrical work.

1.03 QUALITY ASSURANCE

A. Except as otherwise indicated, joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging as indicated for each application. Failures of installed sealers to comply with this requirement will be recognized as failures of materials and workmanship.

1.04 SUBMITTALS

A. Product Data:
1. Submit manufacturer's product specifications, handling/installation/curing instructions and performance tested data sheets for each elastomeric product required.
2. Submit certified test reports for elastomeric sealants on aged performances as specified, including hardness, stain resistance, adhesion, cohesion or tensile strength, elongation, low-temperature flexibility, compression set, modulus of elasticity, water absorption, and resistance (aging, weight loss, deterioration) to heat and exposures to ozone and ultraviolet light.

B. Samples:
1. Submit color charts for selection.
2. Colors to be selected by Architect from manufacturer's entire selection.
3. Multiple colors may be selected for differing substrates and/or conditions throughout the project.

1.05 JOB CONDITIONS

A. Do not proceed with installation of liquid sealants under unfavorable weather conditions. Install elastomeric sealants when temperature is in lower third of temperature range recommended by manufacturer for installation.

1.06 WARRANTY

A. The Contractor shall provide a warranty against failure of sealant materials and workmanship including

replacement of other materials damaged as a result of sealant failure for five (5) years from the date of Substantial Completion. Typical for all sealants at all locations and conditions, unless otherwise indicated.

PART 2 - PRODUCTS

2.01 GENERAL

A. General Sealer Requirements:
1. Select materials for compatibility with joint surfaces and other indicated exposures, and except as otherwise indicated, select modulus of elasticity and hardness or grade recommended by manufacturer for each application indicated.
2. Where exposed to foot traffic, select non-tracking materials of sufficient strength and hardness to withstand "stiletto" heel traffic without damage or deterioration of sealer system.
3. Provide colors as selected by Architect from the manufacturer's entire available color selection. Colors are to be selected for each differing material and condition. Various colors of each product are to be expected.

2.02 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following approved manufacturers:
1. Manufacturers of Elastomeric Sealants (Liquid):
a. "Sonneborn / BASF Building Systems"
b. "Tremco, Inc."
c. "Capital Services"
d. "DOW Corning"
2. Manufacturers of Non-Elastomeric Sealants (Liquid/Tape):
a. "Sonneborn / BASF Building Systems"
b. "Tremco, Inc."
c. "Capital Services"
d. "DOW Corning"
3. Manufacturers of Joint Fillers/Sealant Backers:
a. "Sonneborn / BASF Building Systems"
b. "Backer Rod Mfr. & Supply Co."
c. "Williams Products, Inc."

2.03 ELASTOMERIC SEALANTS

A. For use at interior/exterior joints subject to movement: control joints, expansion joints, etc.

B. Multi-Component Polyurethane Sealant: Except as otherwise indicated, provide manufacturer's standard, non-modified, 2-or-more-part, polyurethane-base, elastomeric sealant; complying with ASTM C920 Type M Class 25, non-sag grade/type.

C. Modulus and Hardness: Where self-leveling grade/type is required, provide sealant with cured modulus of elasticity at 100% elongation of not more than 150 psi (ASTM D 412 test procedure), and Shore A hardness of not less than 55 (ASTM D 2240). Where non-sag grade/type is required, provide sealant with cured modulus of elasticity at 100% elongation of not more than 75 psi and Shore A hardness of 20 to 30.

D. Tear Resistance: Not less than 50 lb. per inch (ASTM D 624).

E. Acceptable Products:
1. "Sonneborn", Sonolastic NP 1.
2. "Sonneborn", Sonolastic NP 2.

3. "Sonneborn", Sonolastic SL I.
4. "Tremco", Dymeric.

2.04 NON-ELASTOMERIC SEALANTS AND CAULKING COMPOUNDS

A. For general use as an exposed building construction sealant provide acrylic terpolymer, solvent-based, one-part, thermo-plastic sealant compound; solids not less than 95% acrylic.

B. Performance Standard: Comply with either ASTM C 920 Type S Class 12-1/2 Grade NS or Class B Type Non-Sag.

C. Bond and Cohesion: Comply with ASTM C 910, with less than 0.50 square inches of combined cohesion and bond failure for three (3) samples.

D. Acceptable Products:
1. "Sonneborn", Sonolac.
2. "Tremco", Mono.

2.05 MISCELLANEOUS MATERIALS

A. Joint Primer/Sealer:
Provide type of joint primer/sealer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Bond Breaker Tape:
Provide Polyethylene tape or other plastic tape as recommended by sealant manufacturer; to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant. Provide self-adhesive tape where applicable.

C. Sealant Backer Rod:
Provide compressible rod stock of polyethylene foam, polyurethane foam, polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended by sealant manufacturer for back-up of, and compatibility with sealant.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed. Do not proceed with joint sealer work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Clean joint surfaces immediately before installation of sealants. Remove dirt, insecure coating, moisture and other substrates which could interfere with bond of sealant. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.

B. Set joint filler units at depth or position in joint as indicated to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

C. Install sealant backer rod for liquid-applied sealants, except where shown to be omitted or recommended to be omitted by sealant manufacturer for application indicated. Install backer rod at all areas required for proper installation of sealant.

D. Install backer rods at any location necessary for proper installation of all sealants, whether shown on drawings or not.

E. Install bond breaker tape where indicated and where required by manufacturer's recommendations to insure that liquid-applied sealants will perform as intended.

F. Employ only proven installation techniques, which will insure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill joints with sealant to a slightly concave surface slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surfaces, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

G. Install liquid applied sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations:
   1. For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
   2. For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in range of 75% to 125% of joint width.

H. Do not allow sealants or compounds to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

I. Do not overheat or reheat hot-applied sealants.

3.03 PROTECTION

A. Cure sealant compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability.

B. Protect joint sealers during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of substantial completion. Replace or restore sealants which are damaged or deteriorated during construction period.

SUBMITTAL CHECK LIST

1. Product Data.
2. Warranty.

END OF SECTION 07 92 00

SECTION 08 11 13 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Hollow metal doors and frames as shown on the Drawings and specified herein, including:
   1. Hollow steel doors and frames.
   2. Hollow steel frames for wood doors.
   3. Hollow metal frames for glass.
   4. Modifying existing hollow metal doors and frames.
   5. Rough bucks, frame reinforcing, door reinforcing, door insulation, closer reinforcements, clip angles and anchorage.
   6. Factory prime paint finish.
   7. Grouting of hollow metal frames with masonry mortar where not covered under other Sections.

1.02 REFERENCES

A. The following standards, tests and publications may be referred to herein and are applicable to this Section:
   1. ANSI A250.8-1998/SDI-100 - Recommended Specifications - Standard Steel Doors and , Steel Door Institute, unless herein specified.
   2. UL 10C-98 and UBC 7-2 – Positive Pressure Fire Tests of Door Assemblies.
   3. NFPA-80-1999 – Standard for Fire Doors and Windows.
   4. NFPA-101-1997 – Life Safety Code.
   5. NFPA-105 – Standard for Smoke and Draft Control Assemblies.
   6. ASTM-A 366-95A – Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality.
   7. ASTM-A 568-95 – Specification for Steel, Sheet, Carbon, and High Strength, Low-Alloy, Hot-Rolled, and Cold-Rolled.
   8. ASTM-A 569-91a – Specification for Steel, Carbon, (0.15 maximum percent), Hot-Rolled Sheet and Strip Commercial Quality.
   9. ASTM-A 924-95 – General Requirements for Steel Sheet, Metallic Coated by the Hot-Dip Process.
   10. SDI-105-92 – Recommended Erection Instructions for Steel Frames.
   11. ANSI A115.1-.18 - Specification for Door and Frame Preparation for Hardware.
   12. ANSI A156.7 - Standard Template Hinge Dimensions.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications for fabrication and installation, including data substantiating products comply with requirements.
   2. Manufacturer's published product data sheets.

B. Shop Drawings:
   1. Show type of door and frame for each opening, sections of all typical members, dimensioned elevations, anchors, reinforcements and other required components.
   2. Preparation for installing hardware and glazing.

1.04 QUALITY ASSURANCE

A. Provide doors and frames complying with Steel Door Institute "Recommended Specifications: Standard Steel Doors and Frames" (SDI-100) and as herein specified.

B. Wind Load Performance Requirements: Comply with wind load requirements of the applicable State Building Code. Deflection shall not exceed 1/175 of span.

C. Supplier Qualification: Qualified direct distributor of products to be furnished. The distributor shall have in their regular employment an A.H.C./C.D.C. or person of equivalent experience who will be available at reasonable times to consult with the Architect, Contractor and/or Owner regarding any matters affecting the total door and frame openings.

D. Installer Qualification: Experience with installation of similar materials.

E. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fire-rated door and frame assemblies that comply with NFPA 80 "Standard for Fire Doors and Windows", and have been tested, listed, and labeled in accordance with ASTM E152 "Standard Methods of Fire Tests of Door Assemblies" by nationally recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
   1. Oversize Fire-Rated Door Assemblies: For door assemblies required to be fire-rated and exceeding sizes of tested assemblies, provide certificate or label from approved independent testing and inspection agency, indicating that door and frame assembly conforms to requirements of design, materials and construction as established by individual listings for tested assemblies.
   2. Temperature Rise Rating: At stairwell enclosures, provide doors which have Temperature Rise Rating of 450 degrees F maximum in 30 minutes of fire exposure.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store doors and frames at the job site in such a manner as to prevent damage.

B. Remove all damaged or otherwise unsuitable doors and frames.

C. Deliver hollow metal doors in manufacturer's protective covering. Handle hollow metal with care to prevent damage.

D. Door Storage: Store doors in upright position, under cover. Place doors on at least 4 inch high wood sills or on floors in manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. If corrugated wrapper on door becomes wet, or moisture appears, remove wrapping immediately. Provide 1/4 inch space between doors to promote air circulation.

E. Frame Storage: Store frames under cover on 4 inch wood sills on floors in manner that will prevent rust and damage. Do not use non-vented plastic or canvas shelters which create humidity chamber and promote rusting. Store assembled frames in vertical position, 5 units maximum in stack. Provide 1/4 inch space between frames to promote air circulation.

F. Deliver doors and frames to the jobsite in stages or shipments as required for phasing, and in a timely manner so as not to delay progress of other trades.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Provide products, as approved by the Architect, by one of the following acceptable manufacturers:
   1. Atlas Companies.
   2. CECO Door Products.
   3. Curries.
   4. Deansteel Manufacturing Company, Inc.
   5. Fenestra.

6. Kewanee Corporation.
7. Mesker.
8. Metal Products.
9. Pioneer Industries, Inc.
10. Republic Builders Products.
11. Steelcraft Manufacturing Company.

2.02 MATERIALS

A. Cold-Rolled Steel Sheets:
1. Commercial quality, stretcher leveled flatness, cold-rolled steel, free from scale, pitting or other surface defects.
2. Complying with ASTM A 366 and ASTM A568.

B. Galvanealed Steel Sheets:
1. ASTM A924, A60 zinc coating.
2. Use galvanealed steel sheets at the following locations, whether indicated or not:
a. All exterior doors and door frames.
b. All doors and frames in kitchens, locker rooms and restrooms.
c. All doors and frames in or directly exposed to swimming pool areas.
d. All doors and frames in any other area that is exposed to moisture for long periods of time.
e. All door louvers and other components within doors that require galvanealed steel sheets.
3. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.

C. Supports and Anchors:
1. Fabricate of not less than 16 gauge galvanized sheet steel.
2. Provide all blocking, backings and supports in all horizontal and vertical members as required for reinforcing of all door hardware as specified in Section 08 71 00.

D. Inserts, Bolts and Fasteners:
1. Manufacturer's standard units, except hot-dip galvanize items to be built into exterior walls.

E. Drip Cap:
1. On all exterior door bottoms.
2. On all exterior door frame heads.

F. Primer:
1. For steel surfaces, use rust-inhibitive zinc oxide primer suitable as a base for specified finish paints.

2.03 FABRICATION

A. General:
1. Fabricate hollow metal work to be rigid, neat in appearance and free from defects, warp, or buckle.
2. Accurately form metal to required sizes and profiles.
3. Weld exposed joints continuously; grind and dress smooth.
4. Provide doors and frames bearing UL labels as scheduled. Construction similar to specified hollow metal work, modified to meet Underwrites Laboratories, Inc. requirements.

B. Galvanealed Steel Sheets:
1. ASTM A924, A60 zinc coating.
2. Internal reinforcing may be manufactured of hot rolled pickled and oiled steel per ASTM-A569.

C. Minimum Gauges of Hollow Metal:

1. Frames:
   a. 16 gauge: Interior door frames.
   b. 16 gauge: Typical labeled interior frames.
   c. 16 gauge: Interior glazed window and opening frames.
   d. 14 gauge: Exterior door frames.
   e. 14 gauge: Typical labeled exterior frames.
   f. 14 gauge: Exterior glazed window and opening frames.
2. Doors:
   a. 18 gauge: Interior doors.
   b. 18 gauge: Typical labeled interior doors.
   c. 16 gauge: Exterior doors.
   d. 16 gauge: Typical labeled exterior doors.
3. Accessories:
   a. 20 gauge: Trim members.
4. Provide heavier gauges at doors, frames and accessories as required by fire rating label, details or specific condition.
5. Entire frame, sidelight and transom unit shall be of the same gauge.

D. Doors:
1. Form face sheets in smooth seamless unbroken surface. Construct doors with smooth flush surfaces, without visible joints or seams on exposed faces or stile edges. Interior and exterior door edge seams shall be full height wire welded and ground smooth.
2. Reinforce, stiffen and sound deaden.
3. Stiffen face sheet with 20 gauge steel stiffener reinforced vertically, full height and width, spot welded to both face sheets. Stiffeners welded together top and bottom.
4. Close top and bottom edges of interior and exterior doors with continuous recessed flush steel channel minimum 16 gauge, extending full width of door, and spot welded to both faces. Provide drain holes in bottom closure of exterior doors.
5. Frame openings for glazing and provide cut-outs for glass and louvers with stops as shown. Form beads of 20 gauge steel; locate on inside of opening.
6. Insulate core of all exterior doors, whether indicated or not, and interior doors where indicated:
   a. Insulate with 1 lb minimum density insulation.
   b. Minimum insulation value R−2 minimum.
7. Labeled Doors: Insulate as required by Underwriters Laboratories. Build in special hardware and provide astragals as indicated. At one hour and at 1-1/2 hour doors at enclosures, maximum transmitted temperature end point shall not exceed 450 degrees F above ambient at end of 30 minutes of fire exposure per U.L.
8. Exterior Hollow Metal Door Louvers: Fabricate louver units of 16-gauge galvanized steel sheets with stationary, weatherproof Z-shaped blades and U-shaped frames, not less than 1-3/8 inch thick. Space louver blades not more than 1-1/2 inch o.c. Assemble units by welding. Provide insect screen on interior side of frame, consisting of 14 by 18 wire mesh in rigid, formed metal frame.
9. Interior Hollow Metal Door Louvers: Fabricate of 20-gauge cold-rolled steel sheets with stationary sightproof inverted V-shaped blades and U-shaped frames. Space louver blades not more than 3 inches o.c. Assemble units by welding.
10. Typical Reinforcement: Provide as required for hardware items. For lock reinforcement, provide manufacturer's standard reinforcement. Provide 12 gauge reinforcement for escutcheons or roses. centering clips to hold lock case in alignment. For door checks, provide 14 gauge channel type reinforcements, 3-1/2 inch deep by 14 inches long, or as required. Hinge reinforcement to be one piece 14 gauge continuous channel welded to the door. Reinforce doors for surface items such as surface and semi-concealed closers, brackets, surface holders and door stops. Drilling and tapping installation of these surface items shall be done in field by hardware installer.
11. Provide to design indicated including: Flush panel doors, flush panel with cut-out as indicated, stile and rail type, stile and rail with door louver.

12. Finish: Provide prime coat finish on doors. Thoroughly clean off rust, grease and other impurities. Grind welds smooth, no marks shall show. Apply metallic filler as required to fill cracks and joints and to level any weld areas or similar imperfections. Sand filler coat smooth.
13. **All exterior metal doors to be Galvanealed Steel Sheets.**

E. Frames:
1. Welded Frames. Knockdown frames not permitted, except where specifically indicated by Architect.
2. Close corner joints tight with trim faces mitered and continuously welded, ground smooth.
3. Provide dust cover boxes for hinge and strike plate cutouts and at all other hardware mortises.
4. Weld temporary steel spreader to feet of both jambs, or strap pairs with heads inverted, as bracing during shipping and handling.
5. Rated frames where indicated on drawings and at all rated door openings.
6. At masonry, provide wire or masonry “T” anchors approximately 24 inches on center.
7. Provide and secure galvanized steel drip cap at all exterior doors, field painted to match frame.
8. Silencers: Provide specified silencers, except where stop does not occur and at smoke gasketed openings, 3 per jamb at single door and one for each door at double doors.
9. Extensions: Reinforce transom bars or mullions as necessary to provide rigid installation. Where required (as at multiple openings) to stabilize large frames, provide frame or mullion extensions to anchor to structure above, proper size to fit within overhead construction. Provide angle clips to fasten to structure.
10. Mullions: Provide mullions, straight and without twist, of tubular design. No visible seams will be accepted. For removable mullions provide reinforcing at frame head.
11. Clearances: Provide and be responsible for proper clearances at metal frames, including for weatherstripping, soundstripping and smoke gasketing. Glass clearance shall be thickness of glass plus clearance each side (1/8 inch minimum exterior - 1/16 inch minimum interior), adjust for installation, glass thickness to allow for glazing and sealant. Where sealed double glazing is indicated, provide rebates minimum of 3/4 inch and provide 1/4 inch clearance at glass edges. Where units fit around concrete blocks (blocks built into frames) obtain actual dimensions of blocks being used to establish minimum clearances.
12. Stops: Set with countersunk or Jackson head screws.
13. Labeled Frames: Construct in accordance with requirements for labeled work. Attach proper U.L. label, Warnok Hersey. "B" labeled frames shall be 1-1/2 hour construction.
14. Joinings: Furnish frames mitered, or coped, and continuously face welded. Grind smooth, and conceal joints for a seamless appearance. Touch up welded surfaces with manufacturer’s standard prime paint.
15. Workmanship: Fabricate so no grind marks, hollow or other out-of-plane areas are visible. At joints of intermediate members (such as mullions and transom bars), provide tight joining, neatly accomplished without holes, burned out spots, weld build up or other defacing work. Fill to close cracks and to preserve shapes. Tightly fit loose stops, to hairline joints.
16. Finish: Clean frames by degreasing process and apply thorough coating of baked-on primer, covering inside as well as outside surfaces. At galvanealed frames, coat welds and other disrupted surface with zinc-rich paint containing not less than 90 percent zinc dust by weight.
17. **All exterior metal frames to be Galvanealed Steel Sheets.**

F. Hardware Preparation:
1. Mortise, reinforce, drill and tap doors and frames for mortised hardware.
2. Prepare strike jamb for 3 silencers on door side.
3. Typical Reinforcing: Provide minimum hinge reinforcement 3/16 inch by 1-1/2 inch by 10 inch. Provide similar reinforcement for hardware items as required to adequately withstand stresses, minimum 12 gauge, including channel reinforcement for door closers and closer arms, door holders and similar items. Provide reinforcement and clearances for concealed in-head door closers and for mortise locks, where applicable.

4. Anchorage: Provide standard and special anchorage items as required.
5. Cover Plates: For hinge and strike plate cutouts, provide fully enclosed pressed steel cover boxes spot welded to frames behind mortises.

G. Finish:
1. Chemically treat and apply manufacturer's standard rust inhibitive primer coat conforming to ANSI A224.1-1990.
2. Coat interior of frame with bituminous paint, minimum 1.5 mils.
3. Prep surfaces to receive finish painting in the field.

H. Fastenings:
1. Provide fastenings, anchors and clips as required to secure hollow metal work in place.
2. Provide Jackson head screws, or flatter.
3. Dimple metal work to receive screw heads.
4. Set stops and other non-structural fastenings with #6 Jackson head self-tapping screws.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine supporting structure and conditions under which hollow metal is to be installed.

B. Verify that frame opening corresponds to dimensions of frames furnished.

C. Check that surfaces to contact frames are free of debris.

D. Do not proceed with installation until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. General:
1. Install in accordance with reviewed shop drawings and manufacturer's printed instructions.
2. Set hollow metal plumb, level, square to proper elevations, true to line and eye.
3. Units and trim shall be fastened tightly together, with neat, uniform and tight joints.

B. Anchorage:
1. Attach anchors to opening.
2. Minimum number of anchors: 3 per jamb.
3. Securely fasten and anchor work in place without twists, warps, bulges or other unsatisfactory or defacing workmanship.
4. Set clips and other anchors with Ramset "shot" anchors or drill in anchors as approved.

C. Frames:
1. Attach frames true to line with adjacent construction.
2. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
3. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
4. At cast-in-place concrete or masonry construction, set frames and secure in place using countersunk bolts and expansion shields, with bolt heads neatly filled with metallic putty, ground smooth and primed.

D. Doors:
   1. Hang doors square to opening.
   2. Minimum Clearances:
      a. At head and jambs: 1/8".
      b. Between meetings edges of pairs of doors: 1/8".
      c. With Floor: 3/4", except 3/8" undercut at handicap accessible doors.
      d. At Threshold: 1/4".
      e. At Handicap Threshold: As required to coordinate with threshold height.
   3. Fit hollow metal doors accurately in their respective frames, within following clearances:
      a. Jambs and head 3/32 inch.
      b. Meeting edges pair of doors 1/8 inch.
      c. Sill where no threshold or carpet 1/4 inch above finished floor.
      d. Sill at threshold 3/4 inch maximum above finished floor.
      e. Sill at carpet 1/4 inch above carpet.

E. Labeled Doors and Frames:
   1. Install in conformance with NFPA Standard 80.
   2. Provide clearances in conformance with NFPA Standard 80.

3.03 ADJUST AND CLEAN

A. Remove dirt and excess sealants from metal surfaces.

B. Touch up marred or abraded surfaces.

C. Lubricate hardware and adjust moving parts to operate smoothly.

D. Remove debris from work area.

E. Prime Coat Touch-Up: Modify existing doors and frames to receive new door hardware.
Cut, patch, weld, bondo, and sand smooth, modified areas.
Modifications will be seamless and not noticeable. Use compatible air-drying primer.

F. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Interior flush pre-fit, pre-machined standard and fire rated type wood doors as shown on the Drawings and specified herein.

B. Modifications to existing doors receiving new door hardware, where applicable.

1.02 REFERENCES

A. WDMA - Window and Door Manufacturers Association: IS 1-A 1997 Industry Standard for Architectural Flush Wood Doors.

B. NFPA-80: Standards for Fire Doors 1999 Edition.

C. Uniform Building Code: UBC 7-2 1997 or UL10C, Positive Pressure Fire Door Assemblies. Category “B” for single swing doors and Category “A” for pairs of swinging doors.

D. NFPA-105: Recommended Practice for Installation of Smoke-Control Door Assemblies, 1999 Edition.

E. NFPA-252: Standard Method of Fire Tests for Door Assemblies.

F. UL: Building Materials Directory.

G. WHI: Directory of Listed Products.

H. ICC/ANSI-A117.1-2003: Accessible and Usable Buildings and Facilities.

I. State and Local Building Codes including the Authority Having Jurisdiction.

1.03 QUALITY ASSURANCE

A. Except as otherwise specified herein, wood doors shall conform with Architectural Woodwork Institute (AWI) Quality Standards and National Woodwork Manufacturer's Association (NWMA) I.S. 1 and I.S. 2.

B. Fire-Rated Wood Doors: Provide wood doors which are identical in materials and construction to units tested in door and frame assemblies in accordance with UBC 7-2 1997 or UL10c, Positive Pressure Fire Door Test Method, and which are labeled and listed for ratings indicated by ITS - Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
   1. Doors: Comply with UBC 7-2 1997 or UL10C where required.
   2. Provide smoke gaskets or fire seals as required by manufacturers' individual authorities in compliance with UBC 7-2 1997 or UL-10C-1998.
   3. Maintain one copy of each compliance document on the project site.
   4. Fabrication of doors shall permit installation in accordance with NFPA Standard No. 80.
   5. Fire doors to be rated UL10C Positive Pressure Category A.

C. WDMA I.S. 1-A 2004 Quality Standard: Window and Door Manufacturers Association Quality Standards for grade of door, core, construction, finish, and other requirements.

D. Temperature Rise Rating: At stairway enclosures, provide doors which have Temperature Rise Rating of 250 degrees F maximum in 30 minutes of fire exposure.

E. Manufacturer must have qualifications specializing in the manufacturing of the products specified in this Section for a period of not less than 10 years.

1.04 SUBMITTALS

A. Manufacturer's Literature:
1. Manufacturer's published catalog data, product data sheets and cutsheets.
2. Certificate of compliance with NWMA I.S. 1.
3. Indicate general construction, jointing methods, hardware and louver locations, locations of cut-outs for glass, thickness of veneers, materials, door swings, special blocking, stile and rail dimensions, undercuts, and storage and installation details. Do not proceed with any fabrication until all details are approved.

B. Shop Drawings:
1. Show elevations, dimensions, construction details, glazing, cut-outs and label.

C. Samples:
1. Actual samples of wood veneer and finish.
2. Stain colors and finishes to be selected from manufacturer's entire standard selection.
3. If stains are required to be custom matched, submit samples of actual finished product, along with sample of item door was to be matched to.

D. Warranty:
1. Manufacturer's standard warranty for materials.
2. Special Warranty as specified herein.

E. Certification:
1. Submit any information necessary to indicate compliance to all of these specifications.
2. All labeled fire door assemblies to be of a type which have been classified and listed in accordance with the latest edition of NFPA 80 and tested in compliance with NFPA-252, and UL-10B, and UBC-7-2.
3. A metal label is to be permanently affixed to the fire door at an authorized facility. Furthermore, all, 45, 60, and 90 minute labeled fire doors, are to have manufacturer’s standard laminated stiles for improved screw holding and split resistance capabilities.

1.05 DELIVERY, STORAGE AND HANDLING

A. Do not deliver doors to the site until building has been closed in and is thoroughly dry.

B. Deliver pre-finished wood doors to jobsite after all door frames have been painted, and all “wet” construction has been completed.

C. Plastic wrap and protect wood doors during transit, storage and handling, to prevent damage, soiling or deterioration. Follow the Care and Installation guidelines as described in WDMA I.S. 1-A 2004.

D. Store doors flat and protect from damage.

E. Do not walk or stack any materials on top of any wood doors delivered to the jobsite, and do not drag any wood doors across each other during delivery or installation.

F. Remove damaged or otherwise unsuitable doors from the job site.

1.06 SPECIAL WARRANTY

A. The Contractor shall warrant the wood doors to be free of faults and defects for the life of the installation.

B. Faults and Defects:
1. Delamination in any degree.
2. Warp or twist of 1/4” or more, in any 7’-0” plane, in any direction.
3. Telegraphing of stile, rail, or core, through the face of the door to cause surface variation in excess of 1/100” in any 3” span.
4. Any other defect that shall affect the operation of the door, shall be considered a defect under the provision of the warranty.

C. Warranty to include refinishing and reinstallation that may be required due to repair or replacement of any defective doors.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following acceptable manufacturers:
1. Algoma Hardwoods.
2. Chappell.
3. Eggers Industries.
4. Graham Manufacturing.
5. Ideal Wood Products.
6. Marshfield Door Systems.
7. Mohawk Flush Doors.
8. Ohio Valley.
9. Oshkosh.
10. VT Industries.

2.02 FABRICATION

A. Typical Doors, Non-Fire Rated:
1. Thickness: 1-3/4 inches.
2. Interior flush, bonded, solid core, hardwood veneered.
3. Door construction shall conform to WDMA I.S. 1-A 2004 Premium Grade and AWI Quality Standards Premium Grade.
4. Core: bonded particle core (PC).
a. Solid particleboard bonded to the stiles and rails.
b. Comply with ANSI-A208-1 Grade 1-LD-2.
5. Vertical Stiles: Hardwood to match face veneer, 1-3/8” minimum before trimming, over structural composite lumber (SCL), glued to core.
6. Rails: Mill option hardwood or SCL. Top and bottom: 2 inches before trimming.
7. Facing: Wood veneer cut and species as specified shall conform to WDMA I.S. 1-A 2004 "A" grade for Premium Grade Door Construction requirements.
8. Crossbands: Hardwood, 1/16 inches thick, extending full width of door.
9. Edge Bands: Same species as face veneer, matched for color.

B. Provide all blocking, backings and supports in all horizontal and vertical members as required for reinforcing of all door hardware as specified in Section 08 71 00.

2.03 WOOD VENEER

A. Face Veneer:
1. Shall meet quality standards conforming to WDMA I.S. 1-A 2004 "A" grade for transparent finish.
2. Minimum face veneer thickness shall be 1/50” after finish sanding.
3. Wood Species: Select White Birch.
4. Face Cut: Plain Sliced.

5. Face Assembly: Book Match.
6. Face Symmetry: Running Match.

2.04 VISION FRAMES

A. Non-Rated Doors:
   1. Flush bead wood frames, 1/2" thickness.
   2. Hardwood of same species as face veneer, matched for color.

B. Glass:
   1. Refer to drawings for type and thickness.
   2. See Section 08 81 00 - Glass and Glazing.

2.05 FITTING AND FINISHING

A. Fitting:
   1. Doors may be fitted for hardware at job site or pre-fitted and pre-machined at factory.

B. Factory Finish:
   1. Generally, all doors shall be prefinished at the factory, unless indicated as field stained or a custom stain match is required.
   2. Selected finish color must be able to be matched.
   3. Transparent Finish shall match finish requirements indicated in AWI-“TR6”.
   4. Comply with referenced AWI “Factory Finishing” for Premium Grade factory finish systems.
   5. Finish wood doors using three coats of water-clear, 100% solids, modified acrylic urethane, cured immediately with ultra-violet light. Factory seal all doors on all 6 sides.

C. Coordination:
   1. Finish or stain doors before hanging.
   2. Variations in finish due to body oils on doors, planer marks or other irregularities not attributable to natural wood grain variations will be cause for rejection.

2.06 ADHESIVES

A. Adhesives:
   1. Face to core adhesives shall be Type I or Type II as appropriate for location in building.
   2. All adhesives must be classified Type I or Type II per WDMA TM-6 “Adhesive Bond Test Method.”
   3. Use Type I adhesives for doors in exterior applications.
   4. Use Type II adhesives for doors in interior applications.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine door frames and verify that frames are correct type and have been installed as required for proper hanging of corresponding doors. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb, square, and level jambs and heads.

C. Modify existing wood doors to receive new door hardware, where applicable. Drill, Cut, patch, and sand smooth, modified areas. Modifications shall be seamless and not noticeable. Use touch up stain provided by custom stain manufacturer. Clear coat with Polyurethane after custom stain has dried.

3.02 INSTALLATION

A. Condition doors to average prevailing humidity in installation area prior to hanging. Install doors after building humidity is at an acceptable level.

B. Handle doors in accordance with recommendations of WDMA I.S. 1-A, “Care and Installation at Job Site”.

C. Install wood doors in strict accordance with manufacturer's published instructions and as shown.

D. Install accurately in frame. Install within the clearances specified in the manufacturer’s written instructions. Install plumb, level, square and true.

E. Install to operate freely, but not loosely, free from hinge and strike binding conditions. All doors shall be free from rattling when in the latched position.

F. Pilot holes to be drilled for screws attaching hinges, locksets, and all other hardware to be installed on the doors. Pilot holes shall not exceed 90% of the diameter of the screw.

G. Remove and replace all doors found to be warped, twisted, bowed, or otherwise damaged. Do not install doors which cannot be properly fitted to frames.

H. Adjust pre-finished doors and hardware and other moving or operating parts to function smoothly and correctly.

I. Ensure that smoke gaskets are in-place before pre-finished door installation.

J. Bevel non-fire rated doors 1/8 inch in 2 inches lock and hinge edges.

K. Fit to frames and machine for hardware to whatever extent not previously worked at factory as required for proper fit and uniform clearance at each edge.

L. For non-rated doors provide the following clearances:
   1. 1/8 inch at jambs and heads.
   2. 1/2 inch at floor finish or covering.

M. For installation of hardware, See Division 08710 - Finish Hardware.

3.03 ADJUST AND CLEAN

A. Rehang or replace doors which do not swing or operate freely.

B. Refinish or replace doors damaged during installation.

C. Protect installed wood doors from damage or deterioration until Substantial Completion.

D. Adjust doors for a smooth, balanced, fully functional opening.

E. Clean pre-finished doors and hardware.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Shop Drawings.
3. Samples.

4. Warranty.
5. Certification.

END OF SECTION 08 14 16

SECTION 08 31 13.01 - ACCESS DOORS

PART 1 - GENERAL

1.01 WORK INCLUDED
- A. Metal access doors as shown on the Drawings and specified herein, including:
  1. Access doors in walls.
  2. Access doors in ceilings.

1.02 QUALITY ASSURANCE
- A. Fire Resistive Ratings:
  1. Where access doors are shown in rated assemblies, provide panel door, frame, hinge and latch from manufacturer listed by Underwriters Laboratories for ratings indicated.

- B. Use manufacturer's standard size units for nominal sizes indicated. Field coordinate actual unit sizes with rough openings and built-in anchors and inserts.

1.03 DELIVERY, STORAGE AND HANDLING
- A. Deliver materials to job in manufacturer's unopened packages with labels intact.

- B. Store and handle products so as to prevent damage. Remove all damaged items from the job site.

1.04 SUBMITTALS
- A. Product Data:
  1. Manufacturer's published catalog information, product data sheets and cutsheets.
  2. UL fire rated test data stating achieved rating.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
- A. Provide products, as approved by the Architect, from one of the following acceptable manufacturers:
  1. Babcock-Davis.
  2. Bilco.
  3. Dayton.
  4. J.L. Industries.
  5. Karp Associates, Inc.
  6. Milcor Incorporated.
  7. Vestal Manufacturing Co.

2.02 MATERIALS
- A. Access Doors:
  1. Door: 14 gage steel.
  2. Frame: 16 gage steel with 1 inch flange.
  3. Hinge: Concealed spring type, 175 degree opening.
  4. Lock: Screwdriver activated cam lock.
  5. Finish: Gray baked enamel prime coat. Prepped for finish field coats.
  6. Sizes: 20 inches x 40 inches minimum at attic access, unless otherwise indicated on Drawings. 24 inches x 24 inches all other locations, unless otherwise indicated on Drawings.

- B. Fire-Rated Access Doors:
  1. Door: 20 gage steel, insulated sandwich panel construction.
  2. Frame: 15 gage steel with 1 inch flange.

3. Hinge: Concealed pin type.
4. Lock: Recessed turn ring with interior latch release.
5. Closer: Spring type closer, adjust to assure positive latching.
6. Finish: Gray baked enamel prime coat. Prepped for finish field coats.
7. Sizes: 20 inches x 40 inches minimum at attic access, unless otherwise indicated on Drawings.
   24 inches x 24 inches all other locations, unless otherwise indicated on Drawings.
8. Label: 1-1/2 hour - "B" label, unless otherwise indicated on Drawings.

2.03 FABRICATION

A. Fabricate units of continuous welded construction.

B. Neatly fit all joints, and grind welds smooth and flush with adjacent surfaces.

C. Furnish each access door as a complete unit with all parts ready for installation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Field verify all rough opening dimensions.

B. Assure that sufficient inserts, blocking and built-in anchors are provided for secure installation of doors.

3.02 INSTALLATION

A. Install per manufacturer's recommendations.

B. Painting of doors is specified in Section 09 90 00.

3.03 ADJUSTING AND CLEANING

A. Adjust hardware so that all doors operate smoothly and freely.

B. Remove and replace panels or frames which are bowed, warped or damages.

3.04 PROTECTION

A. Protect doors from damage until Substantial Completion.

SUBMITTAL CHECKLIST

1. Product Data.

END OF SECTION 08 31 13.01

SECTION 08 33 13.01 - COILING COUNTER DOOR – ALUMINUM FINISH

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install complete, an aluminum coiling counter door with all required supports, trim and accessories as shown on the Drawings and specified herein.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's catalog data, cutsheets, literature, specifications and installation instructions.

B. Shop Drawings:
   1. Show location of each door, plans, elevations, details and methods of anchorage to openings, details of construction, required clearances, anchors, and accessories, locations and installation of hardware, size, shape, and thickness of materials, joints and connections.

C. Samples:
   1. Submit aluminum finish samples for selection and approval.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver and store unit in manufacturer's carton properly labeled as to product, project, etc.

B. Protect unit from moisture and construction damage.

1.04 WARRANTY

A. Provide manufacturer's written guarantee against defects in material and workmanship for a period of two (2) years from Substantial Completion.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Provide one of the following approved products (typical counter door, non-rated):
   1. "Cornell" Rolling Counter Doors, ESC10.
   2. "Overhead Door Corporation" Rolling Counter, 652 Series.
   3. "The Cookson Company" Push-Up Counter Door, CD10 Series.
   4. "Wayne-Dalton Corp." Rolling Counter Shutters.
   5. “C.H.I. Rolling Steel Doors” Counter Shutter, Series 6500.

2.02 MATERIALS

A. Mounting:
   1. Face of wall.
   2. Mount on inside face of room, guides and all items interior to room.
   3. Maintain clearance of full opening in wall.

B. Curtain:
   1. Typical Counter Door, Non-Rated:
      a. Extruded aluminum 6063 alloy, .040" thick minimum.
      b. Interlocking, 1-1/2" high, flat slats with nylon end caps.
      c. Finish: Clear anodized.

C. Bottom Bar:

1. Extruded aluminum 6063 alloy.
2. Reinforcing member attached to bottom of the curtain.
3. Equipped with vinyl astragal/weather seal to cushion the contact point on the counter.
4. Prep to include integral locking mechanism.
5. Finish: anodized aluminum to match curtain.

D. Guides:
1. Extruded aluminum 6063 alloy.
2. Side rail assemblies that bolt to the wall and support the entire weight of the counter door unit.
3. Include pile lining of polypropylene, wool or felt.
4. Finish: anodized aluminum to match curtain.

E. Hood:
1. Extruded aluminum 6063 alloy, .040" thick minimum.
2. Protective sheet metal enclosure for the curtain that provides safety and weather resistance at the head of the counter door and keeps the brackets rigid.
3. Hood may be omitted where shaft is located above a ceiling and concealed from view.
4. Finish: anodized aluminum to match curtain.

F. Shaft:
1. Steel tubing with sealed ball bearings.
2. Contains integral counterbalance torsion springs for assisting operation.
3. 3" diameter minimum outer shaft, 5/8" diameter minimum inner shaft.

G. Locking Device:
1. Padlockable slide bolt on coil side of bottom bar at each jamb extending into slots in guides.

H. Operation:
1. Typical Counter Door:
a. Manual push-up with finger lifts in bottom bar.
b. Removable pull down pole.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Field verify all requirements prior to fabrication including, but not limited to, dimensions, opening coverage, substrates, supports, access and clearances required, and control locations.

B. Strictly comply to manufacturer's installation instructions and recommendations,

C. Coordinate installation with adjacent work and all other trades.
Allow for required clearances for operation and maintenance.

D. Install and anchor structural supports in time for masonry work.

E. Set guides on metal frame in wall opening in true alignment.

F. Anchor guides and hood securely.

G. Test for proper operation. Adjust and lubricate as required for smooth and proper operation without binding, distortion, or any malfunctions.

H. Touch-up and repair any minor damages to finishes and coatings.
Replace in whole if damaged beyond condition acceptable to the Architect and Owner.

I. Provide for proper connection and coordination of automatic closing system at rated doors with activation device and system.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.
3. Samples.

END OF SECTION 08 33 13.01

SECTION 08 41 13 - ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete the aluminum thermal-type and non-thermal type Entrances and Storefronts as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Comply with all Federal, State and Local building codes and regulations.

B. Thermal Performance:
   1. AAMA Test Procedure 1502.7.
   2. Condensation Resistance Factor (CRF) of 43 (min.) at equivalent of 15 MPH wind velocity.

C. Air Infiltration:
   1. ASTM E283.
   2. Maximum infiltration .06 CFM/ft. crack length under static pressure of 6.24 PSF (equivalent of 50 MPH wind velocity).

D. Water Infiltration:
   1. ASTM E331.
   2. No water penetration for 15 minutes with 5 gal./hr./s.f. at 10.0 PSF pressure.

E. Uniform Loading:
   1. ASTM E-330.
   2. Max. 1/175 deflection, no permanent deformation under a load of 25 PSF.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Submit complete shop drawings prior to fabrication.
   2. Indicate metal thickness, construction, installation and anchorage details.

B. Samples:
   1. Section of window wall assembly with glass.
   2. If finish is selected, submit sample of finish indicated.
      If not indicated, submit color and finish samples for selection by the Architect, from manufacturer's entire standard selection.

C. Test Reports:
   1. Submit test reports certified by the mullion manufacturer's testing laboratory.
   2. Show compliance with performance requirements.

D. Warranty:
   1. Submit warranty as specified herein.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, handle and store doors and frames at the job site in such a manner as to prevent damage.

B. Remove all damaged or otherwise unsuitable doors and frames from the job site.

1.05 WARRANTY

A. Provide written manufacturer's guarantee against defective workmanship and materials for a period of two (2) years.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide thermal barrier type mullion window and door system, to be approved by the Architect, as manufactured by one of the following approved manufacturers:
1. "EFCO"
2. "Kawneer"
3. "Tubelite"
4. "Vistawall"
5. “United States Aluminum”
6. “Traco”
7. “Wausau Window and Wall Systems”
8. “Arch Aluminum and Glass”
9. “YKK AP”
10. “Manko Window Systems”
11. “Graham Architectural Products”

B. Clarification that any/all aluminum window, curtain walls and entrances and storefronts in the scope of work are to all be provided by a single source manufacturer for the entire project.

C. Basis of Specification:
1. Window Wall Systems:
a. "EFCO", Series 403 (T), Thermal Storefront Framing.
Provide at all locations exposed directly to the exterior.
b. "EFCO", Series 402 (NT), Non-Thermal Storefront Framing.
Provide at all locations interior to the building, including interior unit of vestibules, unless otherwise indicated.
2. Door Systems:
a. Wide Stile: “EFCO”, Series D500 Wide Stile Doors, 1-3/4” Standard Doors.
b. Custom modified to provide for widths and depths of stiles and rails as indicated on the Drawings, Door Elevations, and as specified herein.

2.02 MATERIALS

A. Aluminum Extrusions:
1. ASTM B 221.
2. Alloy 6063-T5.
3. Finish: Class 1 Anodic Coating with integral color, AA-M12-C22.
Color : Dark Bronze Anodized.

B. Aluminum Sheets:
1. ASTM B209.
2. Alloy 5005 where exposed, 3003 where concealed.
3. Finish: Match extrusions.

C. Fasteners and Anchors:
1. Stainless steel or aluminum, finish to match extrusions at exposed fasteners.

D. Glass:
1. 1 inch insulating glass for all exterior glass applications.

2. 1/4 inch glass for all interior applications and all door units.
3. See Section 08 81 00 for glass specifications.
4. See drawings for window, door and frame elevations.

E. Thermal Break:
1. Poured polyurethane or PVC, standard with manufacturer.
2. 3/8 inch minimum thickness.

F. Setting Blocks:
1. As specified in Section 08 81 00.

G. Glazing Gaskets:
1. Elastomeric gaskets of type recommended by window manufacturer.

H. Glazing Tape:
1. Shimmed polymer type recommended by window manufacturer.

I. Perimeter Joint Sealer:
1. As specified in Section 07 92 00.

J. Backup Joint Filler:
1. Closed-cell expanded polyethylene, as specified in Section 07 92 00.

K. Joint Cleaner:
1. Cleaner recommended by sealant manufacturer for the specified joint surface condition.

L. Joint Primer and Sealer:
1. Compounds recommended by sealant manufacturer for the specific joint surface conditions.

M. Bond Breaker:
1. Polyethylene tape.

N. Weatherstripping:
1. Neoprene, hypalon, vinyl, PVC, as standard with manufacturer, double row, continuous with vulcanized corners.

O. Subsill:
1. High Performance extruded aluminum with thermal break, and integral weep hole system.

P. Provide all blocking, backings and supports in all horizontal and vertical members as required for reinforcing of all door hardware as specified herein or in Section 08 71 00.

Q. Hardware:
1. See Section 08 71 00 – Finish Hardware for all other items not listed herein.
2. Cylinder Collars: Anodized aluminum. Cylinder specified in Section 08 71 00.
3. Weatherstripping (Provide on all exterior doors):
   a. Vinyl, Neoprene, EPDM, TPE (thermoplastic elastomer), or silicone.
   b. Full length and width of opening at each condition.
   c. Provide weatherstripping seal sets at entire perimeter jambs and head of all exterior doors, whether scheduled or not.

d. All weatherstripping sets shall be determined by the door hardware supplier as appropriate to the application and able to provide a weather-tight and weather-proof seal, while allowing proper operation of the door and all other hardware.
e. Jambs and Head:
Manufacturer's standard type per requirements of this specification herein.
f. Meeting Astragal:
Manufacturer's standard type per requirements of this specification herein.
Coordinate with removable mullion, if applicable.

g. Door Bottom Sweep:
Vinyl, Neoprene, EPDM, TPE (thermoplastic elastomer), or silicone weathersweep, screw applied to door with concealed fasteners. Finish to match door.

2.03 FABRICATION

A. Window Wall Members:
1. Main extruded members: Minimum thickness .075 inches minimum.
2. Vertical and horizontal framing members: 2 inches nominal face dimension.
3. Perimeter members: 2 inches nominal face dimension.
4. Overall depth: 4-1/2 inches nominal.

B. Door Members:
1. Minimum Thickness: .075" minimum.
2. Overall Depth: 1-3/4 inches nominal.
3. Vertical Stiles: Provide as indicated on Drawings or Door Elevations (modified wide stile).
If not indicated, provide 5 inches nominal width (wide stile).
Reinforce for continuous hinges specified herein or in Section 08 71 00.
4. Top Rail: Provide as indicated on Drawings or Door Elevations (modified wide stile).
If not indicated, provide 5 inches nominal width (wide stile).
Reinforce for closers or holders specified herein or in Section 08 71 00.
5. Intermediate Panic Rail: Provide as indicated on Drawings or Door Elevations (modified wide stile).
If not indicated, provide 6 inches nominal width.
Location to be centered on panic device with dimension as required by Code and ADA.
Reinforce for panic devices specified herein or in Section 08 71 00.
6. Bottom Rail: 10 inches nominal width (modified). Accessory line as required for extra tall rail.

C. Thermal Break:
1. Provide thermal break on all window members.
2. Poured in place, self-adhering elastomer.
3. Do not violate or bridge the thermal break with hardware or fasteners.

D. Preassemble all units to the greatest extent possible to minimize field jointing and assembly at the site. Disassemble units only to the extent necessary to comply with shipping limitations.

E. Fabricate all units to produce uniform sight lines and to be level, plumb, and in same plane as adjacent panels.

F. Accurately fabricate all joints for proper fit and weld all corners.

G. Provide slotted holes or other acceptable means for erection adjustment.

H. Protect exposed surfaces against damage from scratches and discoloration.

I. Provide fully resilient settings for glass panels by use of neoprene gaskets on both sides of glass.

PART 3 – EXECUTION

3.01 PREPARATION

A. Examine all surfaces of opening and verify dimensions. Installation of frames constitutes acceptance of the existing conditions.

3.02 INSTALLATION

A. Install window walls, doors and hardware in accordance with manufacturer's instructions.

B. Assemble and anchor the various components to allow for expansion and contraction, maintaining a watertight condition.

C. In general, for field assembly, conform to welding and joining requirements specified for shop fabrication.

D. Install items plumb, straight, square, level and in their proper elevation, plane and location, and in proper alignment with other work. Employ only skilled workmen and erection.

E. Install doors plumb and in alignment with frames. Apply hardware in accordance with hardware manufacturer’s instructions. Drill and tap for machine screws. Adjust door installation for free and easy movement with uniform clearances and contact at stops.

F. Use shims as required.

G. Caulk perimeter after all lime, mortar, plaster and other corrosive materials have been removed from aluminum surface with solvents not harmful to finish. Provide backer rods as required.

H. Install glass in window walls in accordance with recommendations of the mullion system manufacturer and requirements specified in Section 08 81 00.

SUBMITTAL CHECKLIST

1. Shop Drawings.
2. Samples.
3. Test Reports.
4. Warranty.

END OF SECTION 08 41 13

SECTION 08 51 13 - ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools supervision and services required to install and complete the following systems:
   1. Aluminum thermal-barrier type windows with operable sections installed in storefront systems.

1.02 QUALITY ASSURANCE

A. Performance Classification: AAMA PA3HP.

B. Air Infiltration:
   1. ASTM E283.
   2. Maximum infiltration .10 CFM/ft. crack length under static pressure of 6.24 PSF (equivalent of 50 MPH wind velocity).

C. Water Infiltration:
   1. ASTM E331.
   2. No water penetration for 15 minutes with 5 gal./hr./s.f. at 10.0 PSF pressure.

D. Uniform Loading:
   1. ASTM E-330.
   2. Max. 1/175 deflection, no permanent deformation under a load of 25 psf.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Submit complete shop drawings prior to fabrication.
   2. Indicate metal thickness, construction, installation and anchorage details.

B. Manufacturer’s Data:
   1. Certified performance data.
   2. Submit with shop drawings.

C. Warranty:
   1. Submit warranty as specified herein.

1.04 WARRANTY

A. Provide written manufacturer's guarantee against defective workmanship and material for a period of two (2) years and weather-stripping for a period of five (5) years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide systems, as approved by the Architect, from one of the following approved manufacturers:
   1. “EFCO”
   2. “Kawneer”
   3. “Tubelite”
   4. “Vistawall”
   5. “United States Aluminum”
   6. “Traco”
   7. “Wausau Window and Wall Systems”

8. “Arch Aluminum and Glass”
9. “YKK AP”
10. “Manko Window Systems”
11. “Graham Architectural Products”

B. Clarification that any/all aluminum windows, curtain walls, and entrances and storefronts in the scope of work are to all be provided by a single source manufacturer for the entire project.

C. Basis of Specification:
1. "EFCO", 2700 Series.
2. Operable units to be projected outswing (casement), unless otherwise indicated on Drawings.

2.02 MATERIALS

A. Aluminum Extrusions:
1. ASTM B 221.
2. Alloy 6063-T5.
3. Finish: Class 1 Anodic Coating with integral color, AA-M12-C22.
4. Color: Dark Bronze Anodized.

B. Thermal Break:
1. Poured polyurethane or PVC, standard with manufacturer.
2. 3/8 inch minimum thickness.

C. Glazing:
1. All self-contained window units to be pre-glazed and delivered to the jobsite complete for installation.
2. Accommodate 1 inch insulated glass in fixed and ventilating sections.
3. Vinyl bulb-shaped glazing seal.
4. See Section 08 81 00 and Drawings for glass specifications.

D. Screens:
1. Aluminum or nylon mesh with aluminum frame, at all ventilators.

E. Fasteners and Anchors:
1. Stainless steel or aluminum, finish to match extrusions at exposed fasteners.

F. Hardware:
1. Stainless steel or bronze, manufacturers standards.

G. Weatherstripping:
1. Neoprene, hypalon, vinyl, PVC, as standard with manufacturer, double row, continuous with vulcanized corners.

H. Where shown on Drawings, provide aluminum grilles or muntin bars on exterior of window units, 1 inch wide, finish to match windows.

2.03 FABRICATION

A. Fabricate framing, sash, and louvers of extruded aluminum.
1. Nominal depth of sash: 2 inches or 4 inches, as shown on drawings.
2. Nominal width of sash: 2 inches.
3. Snap-in glazing beads.
4. Weep holes in sill.

B. Corners mitered, fit rigid and weather-tight:
   1. Mechanically fastened or welded.
   2. Sealed.

PART 3 - EXECUTION

3.01 ERECTION

A. Install window framing, sash, sill and hardware in accordance with manufacturer's instructions.

B. Set all windows straight, plumb and level.

C. Securely anchor frames to surrounding construction.

D. Use shims as required.

E. Caulk perimeter after all lime, mortar, plaster and other corrosive materials have been removed from aluminum surface with solvents not harmful to finish. Provide backer rods as required.

3.02 PROTECTION

A. Protect windows from damage until substantial completion.

SUBMITTAL CHECKLIST

1. Shop Drawings.
2. Manufacturer's Data.
3. Warranty.

END OF SECTION 08 51 13

SECTION 08 71 00 - FINISH HARDWARE

PART 1 – GENERAL

1.01 WORK INCLUDED

Furnish labor, materials, equipment, special tools, supervision and services required to complete all Finish Hardware work as indicated, noted, detailed, and scheduled on the Drawings and specified herein.

1.02 OWNER VERIFICATION AND REVIEW MEETING

Contractor and hardware supplier are required to meet with the Owner to review and verify the hardware schedule and sets per door. Contractor and supplier shall be responsible for verifying door and hardware handings, lockset operations, and keying required. All information, except for keying, shall be included in the submittals prior to being forwarded to the Architect.

1.03 KEYING MEETING

Contractor and hardware supplier are required to meet with the Owner to review and verify all requirements for keys and keying per door. Incorporate and coordinate all locking hardware in the Project to provide for a complete and unified system of keying. A complete keying schedule shall be submitted to the Architect and Owner, for approval, within seven days after the meeting. Determine cylinders and cores required to match or be compatible with any existing building master keying systems in place as per the Owner's requirements.

1.04 QUALITY ASSURANCE

A. Hardware Supplier:
   1. An established firm dealing in architectural commercial door hardware, with an office, sample room, warehousing facilities and an adequate inventory.
   2. Has demonstrated a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project.
   3. Supplier must have, as an employee, an experienced and certified Architectural Hardware Consultant (AHC), who is available to Owner, Architect, and Contractor, for consultation throughout the course of the Work.
   4. Provide a competent technician to service the hardware on the job as may be required.
   5. A regular franchised distributor for all materials required for this project.
   6. Shall replace damaged or defective materials prior to shipment to the site. Repairs not acceptable.
   7. Shall meet with the Owner to review and verify all requirements and keying required.
   8. Shall conduct a comprehensive training class for the Owner's maintenance personnel prior to date of acceptance on all special application mechanical hardware provided under this Section.

B. All work to comply with the latest requirements of ADA, ICC/ANSI A117.1, and the accessibility chapter of the Building Code.

C. All work to comply with the latest requirements of NFPA 80, NFPA 101 and NFPA 252 in providing hardware for all fire rated openings.

1.05 REFERENCES

A. American National Standards Institute (ANSI):
   1. ANSI A117.1, Providing Accessibility and Usability for Physically Handicapped People.
   2. ANSI/BHMA A156.1, Butts and Hinges.
   3. ANSI/BHMA A156.3, Exit Devices.
   4. ANSI/BHMA A156.4, Door Controls-Closers.
   5. ANSI/BHMA A156.6, Architectural Door Trim.
   6. ANSI/BHMA A156.7, Template Hinge Dimensions.
   7. ANSI/BHMA A156.13, Locks & Latches, Mortise.

8. ANSI/BHMA A156.16, Auxiliary Hardware.
9. ANSI/BHMA A156.18, Materials and Finishes.

B. American Society for Testing and Materials (ASTM):
1. ASTM-E2074-2001 Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.

C. Code of Federal Regulations (CFR) Americans with Disabilities Act (ADA):
1. Latest version as adopted, approved and accepted by the State.

D. Door and Hardware Institute (DHI):
1. Keying Systems and Nomenclature.
2. Hardware for Labeled Fire Doors.
3. Sequence and Format for the Hardware Schedule.
4. Abbreviations and Symbols.

E. National Fire Protection Association (NFPA):
1. NFPA 80 Standard for Fire Doors and Windows.
2. NFPA 101 Life Safety Code.
3. NFPA 105 Recommended Practice for the Installation of Smoke-Control Door Assemblies.
4. NFPA 252 Standard Methods of Fire Tests of Door Assemblies.

F. Steel Door Institute (SDI):
1. SDI 100 Recommended Specifications for Standard Steel Doors and Frames.

G. Underwriter's Laboratories, Inc. (UL) - UL Standards for Safety:
1. UL 10C-97 Positive Pressure Fire Tests of Door Assemblies.
2. UL 228 Door Closer-Holders, With or Without Integral Smoke Detectors.
3. UL 305 Panic Hardware.

1.06 SUBMITTALS

A. Hardware Schedule:
1. Submit a completely detailed schedule of finish hardware in “Vertical Format” per the Door and Hardware Institute’s Sequence and Format. Include a complete typewritten schedule indicating every item required for each door or opening. Schedules to include, but are not limited to; the manufacturers, model numbers, materials, types, styles, sizes, handings, finishes, etc.
2. Numbering of hardware sets is to match those as indicated in the Specifications and as noted on the Door Schedule on the Drawings. Cross reference plans and schedules.
3. Include all prep of doors and frames required for hardware, including mounting heights, locations and dimensions.
4. Clearly indicate door sets altered from that specified.

B. Owner Verification and Review Meeting:
1. Submit with submittals, confirmation that the meeting was conducted with the Owner.
2. Include list of those present at the meeting.
3. Itemize all items resulting from discussions of the meeting in a "meeting minutes" format.
4. Review of set functions shall be done on a "per door" basis, and not merely by sets. Sets included herein is for the convenience of review by grouping like conditions and not intended to necessarily be representative of same function for all doors in the set. Verify with Owner.

C. Manufacturer's Product Information:
1. Furnish catalog cutsheets, drawings, and other descriptive data on all hardware items.

2. After final approval of the hardware by the Architect, furnish copies of submittals to door and frame suppliers and any other subcontractors and suppliers necessary for coordination and installation of door hardware complete.

D. Samples:
1. If requested by the Architect, submit one (1) sample of each different item of hardware for approval, accompanied by an itemized list showing where the different items are to be used, the manufacturer's number, the finish, sizes applicable, and the number required.
2. Submit a full sample ring of hardware finishes for all manufacturers included.
3. After review, the samples will be returned to the supplier.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver hardware or templates, or both to factory or to building as required by those furnishing items to which hardware is to be applied.

B. Plainly mark packages or hardware so locations of use may be ascertained without breaking the packages.

C. Deliver work so all work will progress without delay or interruption.

D. The Contractor is responsible for providing adequate locked storage space for the scheduled quantities of hardware when delivered to the job.

1.08 PROJECT CONDITIONS

A. The hardware supplier is responsible to examine the door and frame drawings and elevations to determine the suitability of hardware specified.

B. It will be this supplier's responsibility to furnish the correct hardware to fit the door and frame conditions as indicated for correct and proper operation.

1.09 WARRANTY

A. Furnish manufacturer's limited warranty covering defects in materials and workmanship for periods indicated as follows:

1.	Door Closers:	Minimum Ten (10) years.
2.	Locksets:	Minimum Ten (10) years.
3.	Exit Devices:	Minimum Five (5) years.
4.	Hinges:	Lifecylinderstime.
5.	All Other Hardware:	Minimum One (1) year.

PART 2 - PRODUCTS

2.01 KEYING AND KEYS

A. Key system must be a patented keyway.

B. Key, master key and grandmaster key to Owner's requirements.
The key schedule will be developed by hardware supplier in cooperation with Owner's representative.

C. Provide six (6) grandmaster keys, six (6) master keys per group, and two (2) keys per lock.

D. Engrave all keys with the words **UNLAWFUL TO DUPLICATE THIS KEY**.

2.02 LOCKS, LATCHES AND CYLINDERS

A. All cylinders must be factory keyed.
Provide certification from lock manufacturer stating cylinders have been factory keyed.

B. All cylinders to have removable cores (SFIC to match existing building).

C. Provide construction cores on all doors as required.

D. Hardware supplier must be an authorized stocking distributor of the lock they propose to furnish.

E. Provide a cylinder for every lock requiring one, whether specifically specified or not.

F. Unless specifically indicated otherwise, all cylinders supplied throughout the entire project are to be capable of being keyed using the Owner's existing master keying system. Key cylinders in dogged panic devices, keyed removable mullions, coiling doors, overhead doors, etc. to match existing building master keying system.

2.03 FINISHES

A. All finishes, typical, are to be:
Satin Chrome US26D (652 Plated Steel, 626 Plated Brass) unless otherwise indicated.
Materials unable to have this finish applied are to have a finish to closely match and compliment (aluminum, dulled chrome, clear satin anodized, satin stainless steel, mil, painted, etc.).

B. All finishes at dark bronze anodized doors to be:
Dark Bronze USL2 (695 Powder Steel, 695 Powder Brass) unless otherwise indicated.
Materials unable to have this finish applied are to have a finish to closely match and compliment (Satin Bronze, Oil-Rubbed US10B/613, Duranodic Dark Bronze 313, dark brown patina, weathered/aged oiled bronze, weathered/aged antique bronze, painted, etc.).

C. All hardware for painted or other aluminum storefront doors to have finish to match doors and frames. Contact Architect during bidding for any clarifications or concerns in providing finishes to match.

D. Contact Architect during bidding for any clarifications or concerns for finishes to be provided.

2.04 HARDWARE SETS

A. Verification:
1. The following schedule is intended to describe, in general, the types and quantities of hardware required for the various types of doors and for the other parts of the building which will require hardware. Do not consider this schedule as entirely inclusive.
2. Hardware supplier is responsible for visiting the jobsite and reviewing the requirements for each installation. The supplier shall be responsible for providing all hardware as required to serve the door's intended purpose and intent, and include all costs for such in their bid.
3. Hardware supplier is responsible for coordination of all hardware items used together in conjunction with one another, mounting as required to coordinate with all doors and frames as designed, and include all costs for such in their bid.
4. Hardware supplier is responsible for conducting the Owner Verification and Review Meeting, incorporating all items into submittals, and include all costs for such in their bid.
5. Hardware supplier is responsible for conducting the Owner Keying Meeting, determining cylinders and cores required to match any existing building master keying system, provide and install compatible items and key per Owner's requirements.

B. General Requirements:
1. Provide all fire and smoke seals and gaskets as required per Code for all rated door assemblies and for all smoke partition assemblies; full perimeter at head, jambs and bottom.
2. Provide glass and materials as required to meet and maintain fire ratings for all assemblies.
3. All items as listed in hardware sets are “per door”, unless otherwise indicated.
4. All hardware to be mounted per ADA and ICC/ANSI A117.1.

2.05 HARDWARE PRODUCTS

A. Acceptable Manufacturers:

Hardware Item	**Manufacturer**
Hinges:	Ives, Hager, McKinney, Stanley, Bommer
Locksets (Mortise):	Schlage, Falcon, Best, Sargent, Hager, Dorma
Cylinders:	Schlage, Falcon, Best, Sargent, Hager, Dorma
Keyway Cores:	*Best (MUST use Owner’s existing master keying system)*
Panic Devices:	Von Duprin, Precision (PHI)
Surface Closers:	LCN, Sargent
Wall/Floor Stops:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Wall/Floor Holders:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Removable Mullions:	Von Duprin, Falcon, Detex, Sargent, Dorma, Stanley, Yale, Precision (PHI)
Thresholds:	Hager, NGP, Pemko, Reese, Zero
Seals/Gaskets/Sweeps/Bottoms:	Hager, NGP, Pemko, Reese, Zero
Overhead Drip Guards:	Hager, NGP, Pemko, Reese, Zero
Plates:	Ives, Hager, Rockwood, Trimco
Silencers:	Ives, Hager, Rockwood, Trimco
Automatic Door Bottoms:	Hager, NGP, Pemko, Reese
Position Switches:	Schlage, Securitron
Electric Strikes:	Von Duprin

B. Hinges:

1. All interior standard hinges shall be one of the following:
   a. Ives, 5BB1WT, steel hinge and pin.
   b. Hager, BB1168, steel hinge and pin.
2. All exterior standard hinges shall be one of the following:
   a. Ives, 5BB1HW, brass hinge and stainless steel pin.
   b. Hager, BB1199, brass hinge and stainless steel pin.
3. All continuous hinges shall be one of the following:
   a. Ives, 700, stainless steel.
   b. Hager Roton, 790-900, stainless steel.
4. All continuous hinges shall be one of the following
   (where finish other than clear is desired or to match painted or anodized aluminum storefronts):
   a. Ives, 112HD, aluminum geared.
   b. Hager Roton, 780-112, aluminum geared.
5. Interior and exterior standard hinges shall be 5 knuckle, ball bearing, heavy weight, full mortise, wide throw template type hinges with flush barrel and non-removable pins.
6. All exterior hinges shall be of non-corrosive metals, stainless steel, brass, or aluminum as specified, and appropriate for finishes required. Painted or galvanized steel is not permitted. Hinges on all exterior entry doors and all doors receiving panic hardware shall be continuous hinge type and configuration, full height of door.
7. All interior standard hinges shall be capable of 180 degree throw.
   Use wide throw hinges where necessary to clear jamb trim. Provide same material and finish as standard hinges such that all hinges match for like use and applications.
8. All continuous hinges at access control doors are to be provided with electric power transfer prep, located and sized as required to coordinate with devices, equipment, and wiring needs.
9. Except where label provisions require larger or heavier hinges or where specified otherwise:
   a. Provide 1-1/2 pairs of hinges for each door up to 7'-6".
   b. Provide 2 pairs of hinges for doors over 7'-6".
   c. Use 4-1/2" hinges on doors up to 3'-4" wide.
   d. Use 5" hinges on doors over 3'-4" wide.

C. Locksets (Mortise):
1. All heavy-duty Grade 1 mortise locksets shall be one of the following:
   a. Schlage, L Series, "06" lever and "A" rose.
   b. Falcon, MA Series, “Dane” lever and “Gala” rose.
   c. Best, H Series, 45H, "15" lever and "H" rose.
   d. Sargent, 8200, "L" lever and "LN" rose.
   e. Hager, 3800 Series, “Withnell” lever and “Sectional” rose.
   f. Dorma, ML9000 Series, “LR” lever and escutcheon.
2. Provide full face escutcheon on all exterior door conditions in lieu of rose.
3. Provide integral deadbolt where deadbolts are identified.
4. All functions and operations as selected by Owner from all manufacturer's available.

D. Panic Devices (Rim Type):
1. All panics shall be one of the following:
   a. Von Duprin, 99 Series, “06” lever design.
   b. Stanley (PHI), Apex 2100 Series, “A” lever design.
2. Provide Lever Trim with ANSI Function “08” on exterior of all devices, unless indicated otherwise. Only compression springs shall be used in devices, latches and outside trim and/or controls.
3. All exterior doors to receive locking cylinders with night latch function, unless indicated otherwise.
4. Provide Cylinder Dogging on all devices, unless specifically indicated otherwise.
5. Provide cylinders for all panic devices to be compatible for brand of locksets provided and/or for building’s master keying system.

6. Provide fire rated devices for all rated door assemblies.
7. Exterior panic doors to have universal function, adjustable in the field for operation as desired.
8. All functions and operations as selected by Owner from all manufacturer's available.
9. Exit devices shall be tested to ANSI/BHMA A156.3 test requirements by a BHMA certified laboratory. A written certification showing successful completion of a minimum of 1,000,000 cycles shall be provided upon request.
10. Touch pad shall extend a minimum of one half of the door width. Maximum unlatching force shall not exceed 15 pounds. End cap will have three-point attachment to the door.
11. Provide roller strikes for all rim and surface-mounted vertical rod devices, ASA strikes for mortise devices, and manufacturer’s standard strikes for concealed vertical rod devices.
12. All devices to incorporate a security dead-latching feature.
13. Provide removable mullion for any pair of doors where panic devices are used, whether scheduled or not, and whether frame is existing or new. Prep frames as required.

E. Electrified Panic Devices:
1. All electrified panics shall be one of the following (to match series of all others specified):
   a. Von Duprin, 99 Series, “06” lever design.
   b. Stanley (PHI), Apex 2100 Series, “A” lever design.
2. Provide equal to Von Duprin E996L electrified Lever Trim with cylinder operation for night latch function. Credential reader to signal solenoid to electrically unlock lever trim to allow building access.
3. Provide Cylinder Dogging on all devices, unless specifically indicated otherwise.
4. Provide cylinders for all panic devices to be compatible for brand of locksets provided and/or for building’s master keying system.
5. Provide equal to Von Duprin EPT-2 Power Transfer (if power transfer not supplied by continuous hinge).
   Provide equal to Von Duprin PS902 Power Supply.
   Provide equal to Von Duprin 900-2RS option for 2 relay EL panic device control board.
   Provide equal to Von Duprin 900-BB option for battery backup.
   Provide equal to Von Duprin 900-FA option for input of a normally closed fire alarm contact to the fire alarm system.
6. Field convertible between Fail-Safe and Fail-Secure.
   Upon loss of power, the panic device and trim shall fail to Fail Secure condition so that the door remains in a locked position to maintain security to the building and spaces.

F. Surface Closers:
1. Push side condition (with parallel arm) shall be one of the following:
   a. LCN, 4110 Series (4111 cylinder).
   b. Sargent, 281 Series.
2. Pull side condition (with non-parallel arm) shall be one of the following:
   a. LCN, 4040 Series (4041 cylinder).
   b. Sargent, 281 Series.
3. Provide reduced force ADA cylinder.
4. Door closers shall be hydraulic, full rack and pinion action with a high strength cast iron cylinder. Cylinder body shall be 1-1/2” diameter, and double heat-treated pinion shall be 11/16” diameter. A written certification showing successful completion of a minimum of 1,000,000 cycles shall be provided upon request.
5. All closers shall have forged steel main arms and forearms.

6. Mounting shall be on the inside face of the door, interior to the room. Closers shall not be seen on the corridor, hallway or public side of the door.
7. All covers shall be metal.
8. All finishes shall be powder coat aluminum.
9. Provide hold open functions where specified. All hold opens to be adjustable set up to 180 degrees.
10. Provide concealed closer in lieu of surface closer where a closer is used in conjunction with overhead stops/holders.
11. In all cases, the manufacturer's recommended table of sizes is to govern the size of closers to be furnished.
12. Use through-bolts to fasten surface closers to mineral core wood and hollow metal doors.
13. Furnish special overhead closers where shown or specified.
14. Provide arms, corner brackets, mounting brackets, or drop plates as required.
15. Provide 180° door swing wherever possible.
16. Reduced force opening of less than 5 lbs. of force for interior hinged doors per ADA.
17. Closing speed of sweep period shall be adjusted so that from an open position of 70 degrees the door will take at least 3 seconds to move to a point 3 inches from the latch per ADA.

G. Wall/Floor Stops:
1. All wall stops shall be one of the following:
   a. Ives, WS401CCV, brass.
   b. Hager, 236W, brass.
2. All floor stops shall be one of the following:
   a. Ives, FS436; FS438 if high stop condition is required, brass.
   b. Hager, 241F; 243F if high stop condition is required, brass.
3. All heavy-duty floor stops shall be one of the following:
   a. Ives, FS18S, steel stud grouted in concrete.
   b. Hager, 269F, steel stud grouted in concrete.
4. Provide stops or bumpers wherever an opened door strikes any part of building construction, whether indicated or not. In general, provide wall mounted stops for all doors.
5. Furnish floor dome type where wall type cannot be used.
6. Furnish heavy-duty floor stops at all exterior entry and panic doors, whether indicated or not.

H. Wall/Floor Holders:
1. All wall holders shall be one of the following:
   a. Ives, WS40.
   b. Hager, 327W.
2. All floor holders shall be one of the following:
   a. Ives, FS40.
   b. Hager, 326F.

I. Removable Mullions:
1. All removable mullions shall be one of the following:
   a. Von Duprin, 4954.
   b. Falcon, 4023.
   c. Detex, 90KR.
   d. Sargent, L980.
   e. Hager, 4900.
2. Rim cylinders compatible with those for locksets.
3. Strikes compatible with panic devices and locksets.

4. Finish painted to match frame.
5. Provide removable mullion for any pair of doors where panic devices are used, whether scheduled or not, and whether frame is existing or new.
6. Provide fire rated devices in all fire rated openings.

J. Thresholds:
1. Aluminum, saddle-type.
2. Fully ADA compliant.
3. Span entire width and depth of opening.
4. 1/2" maximum height.
5. 1:2 ratio bevel slope.
6. Finish to match all other hardware specified for opening, and storefront units where applicable.

K. Seals/Gaskets/Sweeps/Bottoms (used for Weatherstripping):
1. All bottoms for doors with recessed bottom channels shall be one of the following:
   a. Hager, 750SN.
2. All bottoms for doors without recessed bottom channels shall be one of the following:
   a. Hager, 772S.
3. All bottoms to be mil finish aluminum.
4. Provide bottoms on all exterior doors, whether scheduled or not.
5. Weatherstripping to be Vinyl, Neoprene, EPDM, TPE (thermoplastic elastomer), or Silicone.
6. Full length and width of opening at each condition.

7. All weatherstripping sets shall be determined by the door hardware supplier as appropriate to the application and able to provide a weather-tight and weather-proof seal, while allowing proper operation of the door and all other hardware.
8. Provide weatherstripping seal sets at entire perimeter jambs and head of all exterior doors, whether scheduled or not.

L. Seals/Gaskets (used for Sound Seals):
1. All sound seals shall be one of the following:
   a. Pemko, S88 Series.
2. Silicone, adhesive-backed, with compression bulb and stabilizer flange.
3. Full length and width of opening at each condition.
4. Provide sound seal sets at entire perimeter jambs and head.

M. Overhead Drip Guards:
1. All drip strips shall be NGP, 16 Series.
   2-1/2” wide x 1-1/2” high x full width of the door frame.
   Arching horizontal drip shield and vertical fastening leg.
2. All drip strips to be aluminum.
3. Provide clear anodized or bronze anodized finish as applicable to match aluminum door.
   If not an aluminum door, match all other hardware. Provide clear anodized, typical.
4. Install drip strip along top edge of all exterior doors, whether scheduled or not.
   Caulk sealant along top edge.

N. Plates:
1. All kick plates shall be
   height=8", length=2" less than door, unless otherwise indicated, and one of the following:
   a. Ives, 8400.
   b. Hager, 194S.
2. All armor plates shall be

height=36", length=1" less than door, unless otherwise indicated, and one of the following:
   a. Ives, 8400.
   b. Hager, 194S.
3. All plates to be .050” thick minimum, brass, stainless steel, or aluminum.
4. All plates to have beveled edges on all 4 sides.
5. All plates to have countersunk screws.
6. Screw-fasten solid to door.
7. Provide kick plates on the interior side of all doors in a restroom, custodial or janitorial room, mechanical or electrical room, laundry room or other such utility space, whether scheduled or not.
8. Provide armor plates on both sides of all crash or impact doors, whether scheduled or not.

O. Automatic Door Bottoms:
1. All automatic door bottoms shall be one of the following:
   a. Hager, 730S.
   b. NGP, 422.
   c. Pemko, 411ARL.
   d. Reese 521C.
2. Non-handed, reversible, full mortise, flush mounting.
3. Comprised of an aluminum case surrounding a movable drop-bar seal. The drop-bar seal is actuated by a plunger which contacts the jamb as the door closes, forcing the drop-bar seal down against the floor or threshold surface.
4. Mill aluminum finish with black sponge neoprene insert.
5. Provide appropriate type of unit applicable to each door material and thickness.

P. Silencers:
1. All door silencers in metal frames shall be one of the following:
   a. Ives, SR64.
   b. Hager, 307D.
2. All door silencers in wood frames shall be one of the following:
   a. Ives, SR65.
   b. Hager, 308D.
3. Furnish silencers for all interior single and pairs of doors, whether scheduled or not.
4. Omit silencers at doors where they may interfere with other types of seals already required, such as fire rated doors, smoke doors, sound proof doors, or light proof doors.

Q. Position Switches:
1. All position switches for wood doors in wood frames shall be one of the following:
   a. Schlage, 679-05.
   b. Securitron, DPS-W.
2. All position switches for hollow metal doors in hollow metal frames shall be one of the following:
   a. Schlage, 679-05 HM.
   b. Securitron, DPS-M.
3. All position switches for wood doors in hollow metal frames shall be one of the following:
   a. Schlage, 679-05 WD.
4. All position switches for aluminum doors in aluminum frames shall be one of the following:
   a. Schlage, 7764.
5. Monitor the position status of door.
6. Concealed switches, flush-mounted in top of door and head of frame, directly opposite one another.
7. Magnetic switch and a permanent magnet, normally closed.

8. Finish as selected by Architect.

R. Electric Strikes:
1. All electric strikes for cylindrical or mortise locksets shall be one of the following:
   a. Von Duprin, 6200 Series.
2. All electric strikes for panic devices and removable mullions shall be one of the following:
   a. Von Duprin, 6100 Series.
3. Provide Von Duprin PS902 Power Supply.
4. 24 VDC or 12 VDC voltage as selected.
5. Field convertible between Fail-Safe and Fail-Secure.
   Upon loss of power, the electric strike shall fail to Fail Secure condition so that the door remains in a locked position to maintain security to the building and spaces.
6. Adjustable keeper.
7. Internal solenoid.
8. Non-handed.
9. Continuous duty operation.
10. Tamper resistant faceplate.
11. Stainless steel material. Finish on stainless steel to match all other hardware at opening.
12. Hardware supplier is responsible to coordinate the model required with the condition of installation so as to assure proper fit. Verify condition and dimensions of door frames, mullions, removable mullions, and abutting walls where strikes are to be installed.

S. Access Control Door Controllers and Credential Readers:
1. Provided and installed by Owner's separate vendor.

T. Access Control Remote Entry and Camera System:
1. Existing equipment to be salvaged and reinstalled.

2.06 HARDWARE SCHEDULE

NOTE:

For all existing openings receiving new hardware:

**Where new hardware items are scheduled, completely remove all existing items and replace with new as scheduled*
**All existing hardware items not being replaced are to remain*
**Repair existing door and frame as required*
**Repair existing wall and floor surfaces as required*
**Provide covers, trims, and fillers at all existing preps*

Hardware Set #1 *(Exterior, Pair)*
Continuous Hinge (each leaf)
Rim Panic Device (each leaf)
Surface Closer w/ Cush-n-stop arm (each leaf)
Removeable Mullion
Threshold
Weatherstripping (each leaf by 08 41 13)
Door Bottom (each leaf by 08 41 13)
Position Switch (each leaf)

Hardware Set #2 *(Exterior, Pair, Access Control)*
Continuous Hinge w/ electronic power transfer prep (right leaf)
Continuous Hinge (left leaf)

Electrified Rim Panic Device (right leaf)
Rim Panic Device (left leaf)
Surface Closer w/ Cush-n-stop arm (each leaf)
Threshold
Weatherstripping (each leaf by 08 41 13)
Door Bottom (each leaf by 08 41 13)
Removeable Mullion
Position Switch (each leaf)
Access Control Remote Entry and Camera System (reinstall existing components)

Components provided by Owner's separate vendor:
Access Control Credential Reader
Access Control Door Controllers

Hardware Set #3 *(Exterior, Single, Access Control)*
Hinges
Lockset (Storage function)
Surface Closer w/ Cush-n-stop arm
Electronic Strike
Threshold
Weatherstripping
Door Bottom
Position Switch
Kick Plate
Overhead Drip Guard

Components provided by Owner's separate vendor:
Access Control Credential Reader
Access Control Door Controllers

Hardware Set #4 *(Interior, Pair, Access Control)*
Continuous Hinge w/ electronic power transfer prep (right leaf)
Continuous Hinge (left leaf)
Electrified Rim Panic Device (right leaf)
Rim Panic Device (left leaf)
Surface Closer w/ Cush-n-stop arm (each leaf)
Removeable Mullion
Position Switch (each leaf)

Components provided by Owner's separate vendor:
Access Control Credential Reader
Access Control Door Controllers

Hardware Set #5 *(Interior, Single, Access Control)*
Hinges
Lockset (Storage function)
Surface Closer
Electronic Strike
Wall Stop
Position Switch

Kick Plate

Components provided by Owner's separate vendor:
Access Control Credential Reader
Access Control Door Controllers

Hardware Set #6 *(Interior, Pair, Vestibule)*
Continuous Hinge (each leaf)
Rim Panic Device (each leaf)
Surface Closer w/ Cush-n-stop arm (each leaf)
Removeable Mullion
Position Switch (each leaf)

Hardware Set #7 *(Interior, Single, Office Public Entry)*
Continuous Hinge
Lockset (Classroom function)
Surface Closer
Wall Stop

Hardware Set #8 *(Interior, Single, Office Public Entry)*
Continuous Hinge
Lockset (Classroom function)
Surface Closer w/ Cush-n-stop arm

Hardware Set #9 *(Interior, Single, Private Office)*
Hinges
Lockset (Office function)
Wall Stop
Sound Seals
Automatic Door Bottom

Hardware Set #10 *(Interior, Single, Biometric)*
Hinges
Lockset (Finger Print Reader)
Wall Stop
Sound Seals
Automatic Door Bottom

Hardware Set #11 *(Interior, Single, Conference)*
Hinges
Lockset (Passage function)
Wall Stop
Sound Seals
Automatic Door Bottom

Hardware Set #12 *(Interior, Single, Misc.)*
Hinges
Lockset (Classroom function)

Wall Stop

Hardware Set #13 *(Interior, Single, RR)*
Hinges
Lockset (Privacy w/ Occupancy Indicator)
Surface Closer
Wall Stop
Kick Plate

Hardware Set #14 *(Interior, Single, Serving)*
Hinges
Lockset (Classroom function)
Wall Holder
Kick Plate

Hardware Set #15 *(Interior, Single, Utility)*
Hinges
Lockset (Storage function)
Surface Closer
Wall Stop
Kick Plate

Hardware Set #16 *(Interior, Single, Dry Storage)*
Hinges
Lockset (Classroom function)
Surface Closer
Wall Stop
Kick Plate

Hardware Set #17 *(Interior, Single, Kitchen Office.)*
Hinges
Lockset (Office function)
Wall Stop
Kick Plate

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install finishing hardware as recommended by the National Builders Hardware Association.

B. Only use fasteners supplied by the manufacturer. Provide fasteners of suitable size, quantity, type and finish to secure hardware in position for heavy use and long life.

C. Hardware for application on metal surfaces:
   1. Made to standard templates.
   2. Fastening harmonized with hardware as to material and finish.
   3. Fastenings with approved type anchors according to the manufacturer.
   4. In general, ends of through-bolts shall be countersunk.

D. Mount hardware in accordance with current state and federal accessibility standards and guidelines.

E. Install hardware per manufacturers instructions and in compliance with:
1. NFPA-80.
2. NFPA-101.
3. NFPA-105.
4. NFPA-252.
5. ANSI A117.1.

F. Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

G. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

H. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

I. Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section “Joint Sealers”.

J. Weatherstripping and Seals: Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.02 FIELD QUALITY CONTROL

A. Material supplier to inspect hardware after installation and before final acceptance in order to ensure that hardware has been properly installed. If there are any discrepancies the material supplier is to provide the Architect, General Contractor and Installer with a written report detailing any and all discrepancies. All discrepancies are to be corrected prior to final acceptance unless otherwise directed by the Owner.

3.03 ADJUSTING AND CLEANING

A. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit.

B. Immediately prior to Substantial Completion replace all construction cores.

C. Tag all keys.

D. Check each key and each lockset to verify proper working order.

E. Lubricate and adjust all hardware to provide smooth operation.

F. Clean all hardware per manufacturer's instructions after installer makes final adjustments and prior to final acceptance, remove all mortar, drywall mud, paint overspray, foreign materials, labels, markings, soil, oils, etc. Polish all locksets, plates, and other hardware.

G. Clean adjacent surfaces soiled by hardware installation

H. Replace, at no cost to Owner, items that cannot be cleaned to manufacturer's level of new finish quality or that cannot be adjusted to operate freely and smoothly or as intended for the application made.

I. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.

SUBMITTAL CHECKLIST

1. Hardware Schedule.
2. Owner Verification and Review Meeting.
3. Manufacturer's Product Information.
4. Samples.

END OF SECTION 08 71 00

SECTION 08 81 00 - GLASS AND GLAZING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Glass and glazing as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Comply with the following:
   1. Glazing Material:
      a. ANSI Z97.1.
      b. ASTM 1036, Standard Specifications for Flat Glass.
   2. Safety Glazing:
      a. Federal Standard CPSC 16 CFR 1201.
      b. ANSI Z97.1.
      c. ANSI Z97.1q.
      d. U.S. Consumer Product Safely Commission Standard 16 CFR 1201 CI and CII.
      e. ASTM C1172, Standard Specification for Laminated Architectural Flat Glass.
   3. Insulating Glass:
      a. Manufacturing: ASTM E 6 P03, Class CBA.
      b. Installation: SIGMA A-3000.

B. Unless otherwise shown or governed by other reference standards specified, conform with details and procedures of FGMA Glazing Manual.

C. The level of acceptability for glass and glazing products may be more strict than the basic standards referenced herein. The Owner and/or Architect reserve the right to determine whether a product is acceptable for its intended use, in its intended application, for its intended clarity of visibility, and as required for its intended aesthetic effect.

1.03 SUBMITTALS

A. Manufacturer’s Literature:
   1. Materials description and installation instructions for glazing compounds.

B. Samples:
   1. Submit 6” x 6” actual sample of each glass type, color, tint, etc.
   2. Submit 12" x 12" actual sample of insulated units or spandrel units.

C. Warranty:
   1. Submit specified warranty for review.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver glazing materials to project site in manufacturer’s unopened containers, fully identified with trade name, color, size, hardness, type, class and grade. Store each item in accordance with manufacturer’s instructions. Remove all damaged, or otherwise unsuitable material immediately from the job site.

1.05 JOB CONDITIONS

A. Do not perform work under adverse weather or job conditions. Install liquid sealants when temperatures are within lower or middle third of temperature range recommended by manufacturer.

1.06 WARRANTY

A. Provide manufacturer’s warranty for insulated glass units against material obstruction of vision resulting

from moisture infiltration or dust collection between interior glass surfaces for ten (10) years.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following, or as otherwise specifically listed:
   1. "AGC Glass Company North America".
   2. “Guardian Industries”.
   3. “Oldcastle Building Envelope”.
   4. “Pilkington North America, Inc.”.
   5. "Vitro/PPG Industries, Inc.”.

2.02 GLASS TYPES

A. Clear Float Glass:
   1. Glass sheet made by floating molten glass on a bed of molten tin.
   2. Thickness as shown on Drawings or specified herein.
   3. Safety glass in all doors, windows, transoms and sidelights, where required by code and where shown on the Drawings and specified herein, whether required by Code or not.
   4. Safety glass to be laminated or tempered at all exterior units and tempered at all interior units, unless otherwise indicated.
   5. Glass to be clear.

B. Tinted Float Glass:
   1. Thickness as shown on Drawings or specified herein.
   2. All requirements of clear float glass apply as specified above, except glass lites to be tinted.
   3. Body tinted by adding colorants to normal batch of clear molten glass.
   4. Tint color to be as indicated or as selected by Architect from manufacturer's entire selection.

C. Low-E Glass:
   1. Coated to reduce transmission of radiation, infrared, and ultraviolet rays.
   2. Smooth, sputter coating. Pyrolytic coatings are not permitted.
   3. Thickness as shown on Drawings or specified herein.
   4. All requirements of clear float glass or tinted float glass apply as specified above, except glass lites to be Low-E coated and applied to surface 2 (from outside face).
   5. See Tinted Float Glass for tint color, where tinted glass is required.
   6. Provide one of the following approved products, or an approved equal:
      a. “AGC”; Energy Select 36.
      b. “Guardian”, SunGuard SuperNeutral 68.
      c. “PPG”, Solarban 60.

D. Laminated Safety Glass:
   1. Thickness as shown on Drawings or specified herein.
   2. (2) lites of equal thickness of heat strengthened clear or tinted float glass.
   3. .030” polyvinyl interlayer.
   4. Inner lite clear. Tint outer lite if tinted glass is required.
   5. See Tinted Float Glass for tint color, where tinted glass is required.

E. Tempered Safety Glass:
   1. Thickness as shown on Drawings or specified herein.
   2. Single thickness of clear or tinted float glass.

3. Reheated to just below melting point and suddenly cooled for tempering.
4. Upon major impact, the glass surface shall shatter into small pieces free of sharp points or slivers.
5. See Tinted Float Glass for tint color, where tinted glass is required.

F. 1” Insulating Glass:
1. Manufacturer’s standard units comprised of (1) 1/4” outdoor lite and (1) 1/4" indoor lite with an overall nominal thickness of 1”.
2. Complete units tested and approved in accordance with requirements of the Sealed Insulating Glass Manufacturer’s Association (SIGMA).
3. Outdoor Lite:
   a. 1/4" Low-E glass, tinted
   b. Tempered safety glass.
   c. All requirements of Low-E glass apply as specified above.
   d. See Tinted Float Glass for tint color.
4. Indoor Lite:
   a. 1/4" clear float glass,
   b. Laminated safety glass.
   c. All requirements of laminated or tempered safety glass apply as specified above.
5. Separate outdoor and indoor lites by 1/2” desiccant spacer bar.

G. Spandrel Glass:
1. Manufacturer’s standard units comprised of (1) 1/4” outdoor lite and (1) 1/4" indoor lite, separated by an air space, and comprising an overall nominal thickness of 1”.
2. Complete units tested and approved in accordance with requirements of the Sealed Insulating Glass Manufacturer’s Association (SIGMA).
3. Outdoor lite:
   3. Outdoor lite:
   a. 1/4" Low-E glass, tinted, laminated or tempered safety glass.
   b. All requirements of Low-E glass apply as specified above.
   c. See Tinted Float Glass for tint color.
4. Indoor lite:
   a. 1/4" solid tint primer spandrel glass.
   b. Bright, colored, opaque, highly reflective decorative finish.
   c. Spandrel coating to be applied to surface 4 (from outside face).
   d. Spandrel coating to be applied to surface 3 (from outside face), only if interior face of spandrel panel is intended to be left exposed to view.
5. Separate outdoor and indoor lites by 1/2” desiccant spacer bar.
6. At least one of the outer or inner lites must be laminated safety glass.
   Preferable for the exterior lite to be laminated unless coating and/or tinting prohibit it.
7. Acceptable Manufacturing Method - Opacified Coating:
   a. Glass which has been processed to apply a silicone elastomer or opacified organic coating on the inside/back face of the spandrel panel.
   b. Provide one of the following approved products, or an approved equal:
      1) “ICD Coatings”, Opaci-Coat-300.
      2) “Guardian”, DecoCristal, Back-Painted Glass.
8. Spandrel panel color to be selected by Architect from manufacturer’s entire selection.
   Color intended to match tinted glass selected, unless specifically indicated otherwise.

2.03 MISCELLANEOUS MATERIALS
A. Glazing Sealant for Exterior Glazing:

1. One Part Silicone, FS TT-S-00230C, Type II, Class A.
2. Provide one of the following approved products:
   a. “General Electric Company”, 1200 Series.
   b. “Dow Corning Corporation”, Dow Corning Silicone Rubber Sealant.
   c. “Tremco”, Proglaze Silicone Construction Sealant.
   d. “Pecora Chemical Corporation”, 863.
   e. “DAP, Inc.”, Dap Flexiglaze 1231 Glazing Compound.

B. Glazing Tape:
   1. Polyisobutylene / butyl.
   2. Provide one of the following approved products:
      a. “Tremco”, Tremco 440 Tape.
      b. “Pecora Chemical Corporation”, G-66.
      c. “Pecora Chemical Corporation”, BB-50.
      d. “DAP, Inc.”, Butyl Rubber Tape.

C. Setting Blocks:
   1. Neoprene blocks, 80 to 90 Type A durometer hardness.

D. Spacers:
   1. Neoprene blocks, 40 to 50 Type A durometer hardness, 3” long, self-adhesive on one face only.

2.04 FABRICATION

A. Sealed Edge Construction for Insulated Units:
   1. Fabricate units with a permanent, hermetically sealed, dry air or gas filled space of the width indicated, between sheets of glass as indicated.
   2. Except as otherwise indicated, fabricate units with 1/2” wide air spaces.
   3. Label each unit to show compliances with required standards and regulations.
   4. Indicate which face of unit is for exposure to exterior of weather.
   5. Provide removable label except where regulations require a permanent label.

PART 3 – EXECUTION

3.01 PREPARATION

A. Examine all surfaces to receive the parts of the Work specified herein.

B. Verify all dimensions of in-place and subsequent construction.

C. Application or installation of materials constitutes acceptance of the related construction.

3.02 INSTALLATION

A. Employ only experienced glaziers who have had previous experience with the materials and systems being applied. Use tools and equipment recommended by the glass manufacturer.

B. Maintain a minimum temperature of 40°F during glazing unless the manufacturer of the glazing materials specifically agrees to application of his materials at lower temperatures.

C. Clean glazing stops and rabbets to receive glazing materials of all obstructions and deleterious substances which might impair the work. Remove protective coatings which might fail in adhesion of interfere with bond of sealants. Comply with manufacturer’s instructions for final wiping of surfaces

immediately before application of primer and glazing compounds or tapes.

D. Inspect each piece of glass immediately before installation.
Do not install pieces which are defective or damaged in any way.

E. Set glass on setting blocks or shims. Use blocks of proper size and spacing to support the glass in accordance with manufacturer's recommendations.

F. Provide spacers for all glass to separate glass from stops, except where continuous gaskets or tape are required.

G. Set glass in a manner which produces greatest possible degree of uniformity in appearance.
H. Install glass according to manufacturer's recommendations and in accordance with the Flat Glass Marketing Association Glazing Manual.

I. Clean excess sealant or compound from glass and framing members immediately after application, using solvents or cleaners recommended by manufacturers.

3.03 CURING, PROTECTION AND CLEANING

A. Cure sealants in accordance with the manufacturer's instructions to attain maximum durability and adhesion to glass and framing as soon as possible.

B. Remove and replace any glass which has become broken, cracked, chipped, or damaged, in any way and from any source, including weather, vandalism, construction, handling, accidents during the construction period, etc.

C. Maintain glass in a reasonably clean condition during construction so that it will not become stained and will not contribute to the deterioration of glazing materials.

D. Remove labels, clean and polish glass on both faces prior to final inspection. Comply with instructions and recommendations of the glass manufacturer and glazing materials manufacturer for cleaning in each case.

3.04 TESTING OF EXTERIOR GLAZING SYSTEMS

A. After completion of exterior glazing and nominal curing of sealants, perpendicularly from a 3/4" hose at normal domestic water pressure, test each exterior glazing unit. Repair leaks and other defects, and retest as directed. Repair or replace other work damaged by such leaks.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Samples.
3. Warranty.

END OF SECTION 08 81 00

SECTION 09 29 00.01 - GYPSUM DRYWALL – STEEL STUD CONSTRUCTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Gypsum wallboard and gypsum drywall finish as shown on Drawings and specified herein.

B. Non-load bearing interior partition steel stud construction as shown on Drawings and specified herein.

C. Exterior sheathing products where not specifically specified elsewhere.

1.02 QUALITY ASSURANCE

A. Gypsum wallboard construction shall comply with all laws, ordinances, rules, regulations and orders of public authorities having jurisdiction.

B. All material shall be from a single manufacturer.

C. Installation of steel framing members to receive gypsum wallboard shall comply with ASTM C754.

1.03 REFERENCES

A. Comply with applicable requirements of ANSI/ASTM C 840 for application and finishing of gypsum board, unless otherwise indicated.

B. Gypsum board terminology standard: GA-505 by Gypsum Association.

1.04 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered to the job in their original, unopened containers or bundles, stored in a place providing protection from damage and exposure to the elements. Remove damaged or otherwise unsuitable material from the job site.

1.05 SUBMITTALS

A. Product Data:
Manufacturer's literature, materials description, cutsheets and recommended installation instructions for systems use.

PART 2 - PRODUCTS

2.01 GYPSUM BOARD

A. Gypsum Board (Non-Fire Rated Assemblies):
1. Provide one of the following approved products:
   a. “Georgia-Pacific”; Gypsum Sheathing.
   b. “USG”; Sheetrock Gypsum Panels.
   c. “Certainteed”; M2Tech Gypsum Board.
2. Manufacture to meet specifications for FS SS-L-30, ASTM C 36 and ASTM C 1396.
3. Provide in maximum lengths available to minimize end-to-end butt joints.
4. Standard type, regular gypsum core gypsum board for all areas, except as otherwise indicated. If needed for specified thickness, provide product in Type X gypsum core.
5. Thickness: 5/8 inch or 1/2", as indicated on the Drawings.
6. Width: 4 feet.
7. Length: 8 feet minimum.
8. Edges: Tapered.

B. Gypsum Board (Fire Rated Assemblies-Type X):
1. Provide one of the following approved products:
a. “Georgia-Pacific”; Gypsum Sheathing, Type X.
b. “USG”; Sheetrock Gypsum Panels, Type X.
c. “Certainteed”; M2Tech Gypsum Board, Type X.
2. Manufacture to meet specifications for FS SS-L-30, ASTM C 36 and ASTM C 1396.
3. Provide in maximum lengths available to minimize end-to-end butt joints.
4. Type X gypsum core gypsum board.
5. Thickness: 5/8 inch.
6. Width: 4 feet.
7. Length: 8 feet minimum.
8. Edges: Tapered.

C. Gypsum Board (Tile Backer Board):
1. Provide one of the following approved products:
a. "Georgia-Pacific"; Dens-Shield Tile Backer.
b. "National Gypsum Company / Gold Bond”; eXP Tile Backer.
2. Manufacture to meet specifications for ASTM C 1178.
3. Provide in maximum lengths available to minimize end-to-end butt joints.
4. Thickness: 5/8 inch or 1/2", as indicated on the Drawings.
5. Width: 4 feet.
6. Length: 8 feet minimum.
7. Edges: Square.
8. Provide at all areas where wall tile is scheduled. See Drawings.

D. Gypsum Board Sheathing Substrate (Non-Fire Rated Assemblies):
1. Provide one of the following approved products:
a. “Georgia-Pacific”; Dens-Glass Sheathing.
b. “Certainteed”; GlasRoc Sheathing.
2. Manufacture to meet specifications for ASTM D 3273.
3. Provide in maximum lengths available to minimize end-to-end butt joints.
4. Fiber glass mats over moisture-resistant gypsum core. Paperless facings.
5. Thickness:
a. Framing at 16 inches o.c.: 1/2 inch, or as otherwise indicated on the Drawings.
b. Framing at 24 inches o.c.: 5/8 inch, or as otherwise indicated on the Drawings.
6. Width: 4 feet.
7. Length: 8 feet minimum.
8. Edges: Square.

2.02 STEEL STUDS

A. Provide Steel Stud Systems, as approved by the Architect, by one of the following manufacturers:
1. "U.S. Gypsum Company" (USG).
2. "National Gypsum Company".
3. "Georgia-Pacific".
4. “Clark Dietrich Building Systems”.
5. “Phillips Manufacturing Co.”.
6. “Marino/Ware”.
7. “CEMCO Steel”.
8. "Flex-Ability Concepts".
9. “MBA Metal Framing”.
10. “Dale/Incor”.
11. “Superior Steel Studs”.

B. System Components:
1. With each type of metal stud and joist required, provide manufacturer's standard runners (tracks), shoes, clips, ties, stiffeners, fasteners, grommets to protect electrical wiring, door jamb reinforcers and accessories as recommended by the manufacturer for the applications indicated, and as needed to provide a complete metal stud system. Where special types, conditions, or products are indicated, provide as required to match gauge, depth and section of associated wall construction.

C. Non-Load Bearing Screw Type Steel Studs:
1. Manufacturer's standard formed light gauge steel studs of the height, size, and gauge indicated, with punched webs to facilitate erection of system and passage of mechanical/electrical service lines. Lateral loading shall have a minimum of 5 lbs. per sq. ft.
2. Steel stud framing at interior partitions:
a. Gauge: minimum 20 gauge and 30 mils thickness, ASTM C645.
b. Depth of Section: 3-5/8 inches, unless otherwise indicated on drawings.
c. Flange width: Not less than 1.25 inches.
d. Shape: Cee shape (returned flanges).
e. Steel and Finish: ASTM A591, commercial quality electrolytic zinc coated steel, class B.
f. Face of flanges: Knurled to facilitate use of self-tapping fasteners.
g. Use 1-1/2 inches cold rolled channel at 48 inches o.c. horizontally above interior ceiling.
h. Floor and Ceiling Tracks: Cold formed channel shape, galvanized, width as required to receive studs, and flange/leg size not less than 1.25 inches.
i. Double 20 gauge studs at all door and window jambs.

D. Deflection Stud Runners:
1. Equal to: “Clark Dietrich Building Systems”, SLP-TRK.
2. Positive attachment secured through sides of track, to allow up to 1” vertical movement.
3. Match gauge, depth and section of associated vertical metal stud wall members, minimum 20 gauge and 30 mils thickness.
4. Flange/leg size not less than 1.25 inches.
5. UL approved for use in fire rated assemblies, where applicable.

E. Flexible Steel Stud Runners and Tracks:
1. Equal to: "Flex-Ability Concepts", "FLEX-C TRAC".
2. Galvanized steel sheet track.
3. Zinc-coated steel side bands.

F. Furring Channels or Strips:
1. 7/8” or 1-1/2”, as indicated on Drawings. If not indicated, provide 1-1/2”.
2. 20 gauge, minimum.
3. Cee shape or Hat Channel profile.

2.03 MATERIALS AND COMPONENTS

A. Fasteners:
1. Type S and S-12 screws, bugle head or pan head.
2. Sized to provide 3/8 inch penetration beyond thickness of wallboard.

B. Accessories:
1. Corner reinforcements, casing beads and metal trim, fabricated from 26 gauge galvanized sheet steel with perforated flanges, designed to receive joint compound.

C. Control Joints:

1. "USG", "No. 093".

D. Suspension System for Suspended Gypsum Board Ceiling:
1. "USG/Donn", "Rigid X".

E. Hangar Wires:
1. ASTM A-641, 12 gauge, 0.475 lbs/ft.

F. Reveals:
1. "Gordon, Inc.", "Final Forms I, Series 500".
2. Sizes and shapes as shown on Drawings, or if not shown, 1/2 inch wide reveal.
3. Extruded aluminum.

PART 3 - EXECUTION

3.01 INSTALLATION OF WALLBOARD

A. Single Layer Wallboard - Metal Stud Partitions:
1. Secure metal runners to concrete slabs with power driven anchors, space 24 inches o.c.
2. Space metal studs 16 inches o.c. and locate studs at door and window frames, partition intersections and corners. Locate studs within 2 inches of all door-frame jambs and anchor to jamb and head anchor clips of frame by screw attachment. Over frames a cut-to-length stud extending from door frame header to ceiling runner shall be positioned over vertical joints over door frame. Anchor all frames at jamb anchor clips, after stud and before gypsum wallboard is installed.
3. Sound attenuation blankets shall be pressure-fit between studs.
4. Apply single layer wallboard face out with long dimension vertical. All abutting ends and edges shall occur over stud on different studs. Screws shall be spaced 12 inches o.c. in field of board and 8 inches o.c. staggered along vertical edges.
5. Use wallboard of maximum practical lengths to minimize end joints.
6. Use single panel to span entire length of width of surface where possible.
7. Stagger end joints when they occur.
8. Locate end joints as far as possible from center of wall or ceiling.
9. Butt wallboards without forcing
10. Support ends and edges of wallboard panels on framing or furring members.

B. Wall Board Ceilings - Suspended:
1. Install suspension system level and true, in accordance with manufacturer's instructions, to a tolerance of 1/8 inches in 12'-0".
2. Install suspension system to comply with ASTM C636. Secure only from building structural members. Locate hangers near each end and at 4'-0" along each carrying channel.
3. Install fastener type and spacing per manufacturer or corrosion resistant buglehead drywall screws at 12 inches o.c. in field and 8 inches o.c. along edges; whichever is the most restrictive requirement.

C. Accessories:
1. Corner beads shall be installed on all exterior corners attached with suitable fasteners spaced 9 inches o.c. on both sides, and shall be in single lengths unless corner exceeds standard stock lengths.
2. Metal trim shall be installed over face-layer wallboard, attached with suitable fasteners shaped 9 inches o.c. and shall be in single lengths unless application length exceed standard stock lengths.
3. Wallboard screws shall be applied with an electric driver.
4. Provide control joints at maximum 28’-0” o.c. If additional shrinkage cracks occur, install control

joints and patch cracks.

D. Joint Treatment:
1. Finish all joints and interior corners with joint tape and joint compound.
a. Apply joint compound sufficiently thick to hide board surface at angles and joints. Cover nail/screw heads and depressions with compound.
b. Apply tape, squeeze out excess compound and cover tape with compound.
c. When first coat has thoroughly dried apply two coats of compound, extending each coat slightly beyond previous coat. Sand to smooth, flat surface, ready for specified finish.

E. Finish:
1. Level 5 finish at all exposed areas.
2. If specifically permitted by the Architect, provide Level 4 finish at all exposed areas and Level 5 finish at the following conditions:
a. All walls indicated to receive a skim coating.
b. All walls scheduled to receive a highly reflective wallcovering.
c. All wall areas scheduled to receive a dryerase or projectable wallcovering.
d. All wall areas scheduled to receive a dryerase paint or chalkboard paint.
e. All surfaces of all drywall which is paperless, fiberglass mats, or otherwise textured.
3. Level 2 finish at concealed areas (above ceilings, draftstopping).
4. No textured walls or ceilings.

3.02 CLEANING
A. Remove soil, stain caused by drywall installation.

SUBMITTAL CHECKLIST
1. Product Data.

END OF SECTION 09 29 00.01

SECTION 09 30 00 - TILE

PART 1 - GENERAL

1.01 SUMMARY

A. Related Documents: General and Supplementary Conditions of the Contract, Division 1 General Requirements, and Drawings are applicable to this Section.

B. Section Includes:
1. Porcelain floor tile and base where shown on Drawings.
2. Porcelain tile base where shown on Drawings.
3. Porcelain wall tile where shown on Drawings.

1.02 SUBMITTALS

A. Shop Drawings:
1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control joints, thresholds, and setting details.
2. Locate and detail expansion and control joints.

B. Product Data:
1. Manufacturer's product data sheets, cutsheets, specifications and instructions for using mortars, adhesives, and grouts.

C. Samples:
1. Tile: Submit color samples as specified on Drawings or manufacturer's entire color selection.
2. Grout: Submit color samples as specified on Drawings or manufacturer's entire color selection.

1.03 QUALITY ASSURANCE

A. Single Source Responsibility:
1. Obtain each type and color tile material required from single source.
2. Obtain setting and grouting materials from one manufacturer to ensure compatibility.
3. Furnish a 10 year guarantee from installation material manufacturer. The guarantee is inclusive of installation materials, finish product, and labor.

B. Manufacturer Qualifications:
1. Tile: Minimum 5 years experience in manufacture of tile products.
2. Setting Materials:
Minimum 10 years experience in manufacture of setting and grout materials specified.
3. Membrane: Minimum 5 years experience in manufacture of membrane materials specified.

C. Installer Qualifications:
1. Specializing in tile work having minimum of 5 years successful documented experience with work comparable to that required for this Project.

D. Certifications:
1. Submit "Master Grade Certificate" for each type of ceramic, quarry, and paver tile in accordance with requirements of ANSI A137.1.
2. Submit manufacturer's certifications that mortars, adhesives, and grouts are suitable for intended and specified use.

E. Conform to ANSI- Recommended Standard Specifications for Ceramic Tile - A137.1.

F. Conform to TCA Ceramic Tile: The Installation Handbook.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of Section 01 65 00.

B. Labeling: Comply with ANSI A137.1.

C. Deliver materials in manufacturer's unopened containers, fully identified with name, brand, type, and grade.

D. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.

E. Broken, cracked, chipped, stained, or damaged tile will be rejected, whether built-in or not.

F. Protect mortar and grout materials against moisture, soiling, or staining.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.

B. Do not begin installation until building is completely enclosed and HVAC system is operating and maintaining temperature and humidity conditions consistent with "after occupancy" conditions for a minimum of 2 weeks.

C. Maintain continuous and uniform building temperatures of not less than 50 degrees F during installation nor more than 100 degrees F.

D. Ventilate spaces receiving tile in accordance with material manufacturers' instructions.

1.06 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 78 46 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01 78 00 - Closeout Submittals.

C. Include cleaning and maintenance methods, cleaning solutions recommended, stain removal methods, and polishes and waxes recommended.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. "Portobello America."

2.02 GENERAL

A. ANSI Standards:
   1. Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated.
   2. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

B. ANSI Standard for Tile Installation Materials:
   1. Comply with ANSI standard referenced with products and materials indicated for setting and

grouting.

C. Factory Blending:
1. For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

D. Mounting:
1. Where factory-mounted tile is required, provide back-face or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
2. Where tile is indicated for installation in swimming pools, on exteriors or in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies that this type of mounting is suitable for these kinds of uses and has been successfully used on other projects.

2.03 PORCELAIN TILE

A. Porcelain Floor Tile:
1. Type: As shown on Drawings.
2. Size: As shown on Drawings.
3. Pattern: As shown on Drawings.
4. Color: As shown on Drawings.

B. Porcelain Tile Base:
1. Type: As shown on Drawings.
2. Size: As shown on Drawings.
3. Pattern: As shown on Drawings.
4. Color: As shown on Drawings.

C. Porcelain Wall Tile:
1. Type: As shown on Drawings.
2. Size: As shown on Drawings.
3. Pattern: As shown on Drawings.
4. Color: As shown on Drawings.

2.04 THRESHOLDS

A. Metal Edge Strip:
1. General:
a. Provide metal edge strip at the transition between the tile flooring to the adjacent flooring.
b. Equal to : “Schluter Systems” transition and edge strips.
2. Size and Profile:
a. Bent angle profile with smooth finished edges.
b. Configuration as required to provide proper transition between finished surface of tile and that of the adjacent finished flooring. Refer to transition details on Drawings. Contractor to field verify each condition and notify architect of any conflicts.
c. Height to match the thickness of the tile, with top surface smooth and flush with the tile.
3. Material:
a. White zinc, aluminum or stainless steel.
b. Finish as selected from manufacturer’s standard selection.

2.05 TRIMMERS

A. Provide necessary caps, stops, returns, trimmers and other shapes to complete installation.

2.06 MORTAR MATERIALS - THIN SET BEDS

A. Lightweight Portland Cement; Thin-Set:
1. Provide one of the following acceptable products:
a. "Custom Building Products", ProLite Tile & Stone Mortar or approved equal.
2. Description:
a. Lightweight formula for use with large format tile and stone.
b. Complying with ANSI A118.4TE, A118.15TE and A118.11.

2.07 MEMBRANES, PRIMERS AND SEALERS

A. Crack Isolation and Waterproofing Membrane:
1. Provide one of the following acceptable products:
a. "Mapei", Mapelastic 315.
b. “Custom Building Products”, Red Gard.
2. Description:
a. Trowel applied elastomeric compound.
3. Accessories:
a. Preformed fiberglass mesh coving, inside and outside corners, and drain fittings.
b. Preformed expansion joint flashing.

B. Concrete Slab Primers and Sealers:
1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.
2. Scarify, shot-blast, or sand-blast floor as required at no change in bid price.

2.08 GROUT

A. Epoxy Grout:
1. Provide one of the following acceptable products:
a. "Custom Building Products", CEG2000 100% Solids Epoxy Grout.
b. "Laticrete", Spectralock 2000 IG Chemical Resistant Industrial Grade Epoxy Grout.
c. "Mapei", Kerapoxy Chemical Resistant Grout.
2. Multi-component, factory prepared,100 percent epoxy resin and hardener with sand or mineral filler material.
3. Comply with ANSI A118.3.
4. Color: As indicated or to be selected by Architect from manufacturer’s entire selection.
5. Location: Provide for all floor and wall surfaces, unless indicated otherwise.

2.09 TILE AND GROUT SEALER:

A. Stripper:
1. Provide one of the following acceptable products:
a. "Custom Building Products", Tile Lab Heavy-Duty Cleaner and Stripper.
2. To clean surfaces and strip wax and acrylic finishes.
3. Apply to all surfaces in strict accordance with the manufacturer's instructions.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that areas to receive tile installed by thin bed method have wood float finish and pitched to drains.
Substrates are to be true within 1/8 inch in 10'-0” (for all tiles 18” and larger).
Substrates are to be true within 1/4 inch in 10'-0” (for all tiles smaller than 18”).

B. Condition of Surfaces to Receive Tile:
1. Firm, dry, clean and free of oily or waxy films, mortar and soil.
2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile installed.

C. Air Temperature and Surfaces in Rooms to Receive Flooring:
1. Between 60 degrees to 90 degrees F, unless otherwise recommended by manufacturers of materials being installed.

3.02 PREPARATION

A. Clean substrates.

B. Wet down or wash dry, dusty surfaces and remove excess water immediately prior to application of tiles.

C. Prepare surfaces in strict accordance with instructions of manufacturer whose setting materials or additives are being used.

D. Acid Based Cleaners: Use not permitted.

E. Scarify concrete substrates with blast track equipment if necessary to completely remove curing compounds or other substances that would interfere with proper bond of setting materials. Clean and maintain substrate in condition required by setting material manufacturer.

F. Do not seal substrate unless required by manufacturer.

G. Prime substrate when required by manufacturer.

H. Blending:
1. For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.
2. If not factory blended, either return to manufacturer or blend tiles at project site before installing.

3.03 INSTALLATION

A. Concrete Slab Primers and Sealers:
1. Install primers and sealers in accordance with manufacturers recommended installation guidelines and details.
2. Apply all concrete slab primers and sealers as required to achieve an acceptable substrate for installation of flooring per flooring manufacturer's requirements. Apply when areas are ready or scheduled to receive flooring without delays to the project or schedule, and without any additional costs or change in time. If floor is required to be sandblasted, shot-blasted, scarified, or otherwise prepared, perform this work at no additional cost or change in time.

B. Crack Isolation and Waterproofing Membrane:
1. Install membrane in accordance with manufacturers recommended installation guidelines and details.
2. Install membrane over cracks of up to 1/8 inch or greater in substrates.
Apply a 12 inch wide strip centered on crack as crack isolation membrane.
3. Install membrane with products or methods approved in writing by membrane manufacturer when joining, sealing, fastening, or adhering sheet membranes.
4. Once all cracks have been addressed, install membrane to entire floor substrate as waterproofing membrane.

5. Flash waterproofing up adjacent walls and surfaces in accordance to manufacturer's details, full height of base.
6. Use preformed cove, corners, and expansion joint flashing.
7. Allow membrane to cure as prior to setting tile.
8. Do not allow construction traffic on membrane.
9. Flood test waterproof membranes after fully cured.
10. Field Quality Control water test when required.

C. Tile Installation, General:
1. Install tile materials in accordance with ANSI A137.1, other referenced ANSI and TCNA specifications, and TCNA "Handbook for Ceramic Tile Installation", except for more stringent requirements of manufacturer or these Specifications.
2. Cut and fit tile tight to protrusions and vertical interruptions and treat with a compatible sealants as required. Form corners and bases neatly.
3. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joint watertight, without voids, cracks, excess mortar, or grout.
4. Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards and Tile Council of North America.

D. Layout:
1. Lay out work to pattern indicated so that full tile or joint is centered on each wall and no tile of less than half width need be used. Do not interrupt pattern through openings. Lay out tile to minimize cutting and to avoid tile less than half size.
2. For heights stated in feet and inches, use courses of full tile to produce nearest attainable heights without cutting tile.
3. No staggered joints will be permitted.
4. Align joints in tile in both directions.
5. Align joints between floor and base tile.
6. Make joints between sheets of tile exactly same width as joints within sheet.
7. File edges of cut tile smooth and even.
8. Cut and fit tile at penetrations through tile. Do not damage visible surfaces. Carefully grind edges of tile abutting built-in items. Fit tile at outlets, piping and other penetrations so that plates, collars, or covers overlap tile.
9. Extend tile work into recesses and under or behind equipment and fixtures, to form complete covering without interruptions, except as otherwise indicated. Terminate work neatly at obstructions, edges and corners without disrupting pattern or joint alignments.
10. Accurately form intersections and returns.

E. Thin Set Method, Floors and Walls, ANSI-108.4, 108.5, 108.14, 108.15, 108.16:
1. Apply mortar or adhesive with notched trowel using scraping motion to work material into good contact with surface to be covered. Maintain 90 percent coverage on back of tile and fully bed all corners.
2. Apply only as much mortar or adhesive as can be covered within allowable windows as recommended by mortar or adhesive manufacturer or while surface is still tacky.
3. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar or adhesive onto back of each tile or sheet of tiles.
4. Set tiles in place and rub or beat with small beating block.
5. Beat or rap tile to ensure proper bond and also to level surface of tile.
6. Align tile to show uniform joints and allow to set until firm.
7. Clean excess mortar or adhesive from surface of tile with wet cheese cloth (not a sponge) while mortar is fresh.
8. Allow face mounted tile to set until firm before removing paper and before grouting.

9. Sound tile after setting. Replace hollow sounding tiles.

F. Grouting, ANSI A108.9- 108.10:
1. Allow tiles to set a minimum of 48 hours before grouting.
2. If bonding materials are rapid setting, follow manufacturer's recommendations.
3. Install in accordance with grout manufacturer's recommendations and ANSI A108.10.
4. Pack joints full and free before mortar takes initial set.
5. Clean excess grout from surface with wet cheesecloth as work progresses. Do not use hydrosponges.
6. Cure after grouting by covering with kraft or construction paper for 72 hours.
7. Install sealant in vertical wall joints at interior corners.

G. Control Joints and Other Sealant Usage, ANSI-A108.1:
1. Install control joints where tile abuts any/all retaining surfaces such as perimeter walls, curbs, columns, wall corners and directly over cold joints and control joints in structural surfaces conforming to architectural details.
2. Install control joint in floors at spacings as indicated in TCNA Installation Handbook, unless noted otherwise.
3. Rake or cut control joints through setting bed to supporting slab or structure. Keep joints free of mortar.
4. Install in full accordance with TCNA Installation Handbook.
5. Fill joints with self-leveling polyurethane sealant and backing material as required.
6. Fill joints around toilet fixtures with white silicone sanitary sealant.

H. Expansion Joints:
1. Keep expansion joints free of mortar and grout.
2. Use manufacturer's expansion joint flashing when covering expansion joints with waterproof or crack isolation membranes.
3. Provide expansion joints directly over changes in material, over control and expansion joints in substrate, at juncture of floors and walls, at other restraining surfaces such as curbs, columns, bases, and wall corners, and where recommended by TCNA EJ171 Expansion Joint requirements.
4. Install sealant in expansion joints.
5. Provide sealant material at items penetrating tile work, unless otherwise indicated.
6. Provide sealants and related materials in accordance with cited ANSI A108.1 and TCNA requirements.

3.04 ADJUSTING

A. Sound tile after setting. Replace hollow sounding units.

3.05 CLEANING

A. Clean excess mortar from surface with water as work progresses. Perform cleaning while mortar is fresh and before it hardens on surfaces.

B. Sponge and wash tile diagonally across joints. Polish with clean dry cloth

C. Remove grout haze following recommendation of mortar additive manufacturer. Do not use acids for cleaning.

D. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

E. Wipe all sealer from glazed surfaces or any other surface that will not accept sealer.

Clean tile surfaces to remove any residue and do not allow to dry on surface.

3.06 PROTECTION

A. Prohibit traffic from floor finish for 72 hours after installation.

B. Where temporary use of new floors is unavoidable, supply large, flat boards or plywood panels for walkways over kraft paper.

C. Protect work so that it will be without any evidence of damage or use at time of acceptance.

SUBMITTAL CHECKLIST

1. Shop Drawings.
2. Samples.
3. Manufacturer's Product Data.

END OF SECTION 09 30 00

SECTION 09 51 13 - ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of acoustical ceilings as shown and scheduled on the Drawings.

B. Types of acoustical ceilings specified in this Section include the following:
   1. Acoustical panel ceilings, exposed grid suspension.
   2. Vinyl-faced gypsum board panel ceilings, exposed grid suspension.

1.02 QUALITY ASSURANCE

A. UL Fire Hazard Classification:
   1. Where acoustical ceilings are indicated to comply with fire hazard classification provide acoustical materials which have been tested, rated and labeled by UL for indicated ratings.
   2. Classification: Maximum of 25 for flame spread.

B. Sound and Noise Classification:
   1. Provide systems with NRC ratings in accordance with ASTM C423 and STC ratings in accordance with AMA1-II, as tested by an independent agency.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data sheets, cutsheets, specifications and installation instructions.

B. Samples:
   1. Where colors are specified, submit one sample of each type of acoustical unit and suspension system member.
   2. Where colors are not specified, or are specified as "to be selected", submit samples showing manufacturer's full range of standard colors for each type acoustical unit and suspension system.
   3. Submit additional or larger samples of selected colors upon request.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site in manufacturers original, unopened packages, with labels intact. Store and handle to avoid damage and exposure to elements. Remove damaged or otherwise unsuitable material from job site.

1.05 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 78 46 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01 78 00 - Closeout Submittals.

1.06 PROJECT CONDITIONS

A. Do not install acoustical ceilings until space is enclosed and weatherproof, and until wet-work in space is completed, and until temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide ceiling panels, as approved by the Architect, by one of the following manufacturers:
   1. "Armstrong"
   2. "U.S. Gypsum" (USG)
   3. "Celotex"
   4. "National Gypsum Company" (NGC)
   5. "Certainteed"

B. Provide suspension systems from same manufacturer as the ceiling panel, as approved by the Architect, or by one of the following manufacturers:
   1. "Armstrong"
   2. "U.S. Gypsum/Donn Ceilings"
   3. "Chicago Metallic Corporation"

2.02 CEILING SYSTEMS

A. Provide the following acoustical ceiling systems as indicated on the Drawings:

1. **Panel and Suspension System Type "A":**
   (Lay-in, 2'x2', Square Edge)
   a. Panel:
      1. Model: "Armstrong", School Zone Fine Fissured #1810.
         "USG", Radar Clima Plus High CAC High NRC #22111.
      2. Size: 2' x 2' x 3/4".
      3. Edge: Square.
      4. NRC: 0.70.
      5. Light Reflect: 0.85.
      6. Color: White.
   b. Suspension System:
      1. Model: "Armstrong", Prelude XL.
         "USG", Donn DX/DXL.
      2. Profile: 2' x 2' grid, 15/16" flange.
      3. Material: Hot dipped galvanized.
      4. Color: White.

2. **Panel and Suspension System Type "B":**
   (Lay-in, 2'x2', Vinyl-Coated Gypsum Board)
   a. Panel:
      1. Model: "USG", Sheetrock Lay-In Ceiling Tile Clima Plus Vinyl #3260.
         "NGC", Gold Bond Gridstone Gypsum Ceiling Panels.
         "Certainteed", Vinylrock X.
      2. Type: Vinyl-coated gypsum board panel.
      3. Size: 2' x 2' x 1/2".
      4. Edge: Square.
      5. Light Reflect: 0.85.
      6. Color: White.
   b. Suspension System:
      1. Model: "Armstrong", Prelude Plus XL-WA, Aluminum Capped.
         "USG", Donn DXLA.
      2. Profile: 2' x 2' grid, 15/16" flange.
      3. Material: Hot dip galvanized with aluminum cap.
      4. Color: White.

2.03 CEILING SUSPENSION MATERIALS

A. Comply with ASTM C 635, as applicable to type of suspension system required for type of ceiling units indicated. Coordinate with other work supported by or penetrating through ceilings, including light fixtures, and HVAC equipment.

B. Structural Class:
   1. Intermediate-duty system.

C. Attachment Devices:
   1. Size for 5 times design load indicated in ASTM C 635, Table 1, Direct Hung.

D. Hanger Wires:
   1. Galvanized carbon steel, ASTM A 641, soft temper, pre-stretched, yield-stress load of at least 3 times design load, but not less than 12 gauge (0.106 inch).

E. Type of System:
   1. Either direct-hung or indirect hung suspension system, as required to meet performance requirements.

F. Carrying Channels:
   1. 1-1/2 inch steel channels, hot-rolled or cold-rolled, not less than 0.475 lbs. per lineal ft.

G. Edge Moldings:
   1. Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed.
   2. 15/16 inch minimum exposed leg, finish to match grid finish.

H. Exposed Suspension System:
   1. Manufacturer's standard exposed runners, cross-runners and accessories, of double web types and profiles indicated, with exposed cross runners coped to lay flush with main runners.
   2. Provide uniform factory-applied finish on exposed surfaces of ceiling suspension systems, including moldings, trim and accessories.
   3. Manufacturer's standard baked polyester finish, low gloss, color as selected.

PART 3 - EXECUTION

3.01 PREPARATION

A. Furnish layouts for inserts, clips or other supports required to be installed by other trades for support of acoustical ceilings.

B. Establish layout of acoustical units in compliance with reflected ceiling plan. Balance border widths at opposite edges of each ceiling. Avoid use of less-than-half width units at borders.

3.02 INSTALLATION

A. Install materials in accordance with manufacturer's printed instructions, and to comply with governing regulations, fire resistance rating requirements as indicated, and industry standards applicable to work.

B. Install all acoustical units with grain in one plane and direction.

C. Install suspension systems to comply with ASTM C 636, with hangers supported only from building structural members. Locate hangers near each end and spaced 4'-0" along each carrying channel or direct-hung runner, unless otherwise indicated, leveling to tolerance of 1/8 inch in 12'-0".

D. Install edge moldings of type indicated at perimeter of acoustical ceiling area and at locations where necessary to conceal edges of acoustical units.
   1. Sealant Bed: Apply continuous ribbon of acoustical sealant, concealed on back of vertical leg before installing moldings.
   2. Screw-attach moldings to substrate at intervals not over 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to tolerance of 1/8 inch in 12'-0". Miter corners accurately and connect securely.

E. Install panels in coordination with suspension system, with edges concealed by support of suspension members. Scribe and cut panels to fit accurately at borders and at penetrations.

F. Install hold-down clips in areas indicated, and in areas where required by governing regulations or for fire resistance ratings; space as recommended by panel manufacturer, unless otherwise indicated or required.

3.03 ADJUST AND CLEAN

A. Clean exposed surfaces of acoustical ceilings, including trim, edge moldings, and suspension members; comply with manufacturer's instructions for cleaning and touch-up of minor finish damage.

B. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

SUBMITTAL CHECKLIST

1. Product Data.
2. Samples.

END OF SECTION 09 51 13

SECTION 09 65 13.23 - RUBBER STAIR TREADS

PART 1 - GENERAL

1.01 WORK INCLUDED
A. Install stair treads with integral risers as indicated on the Drawings and specified herein.

1.02 QUALITY ASSURANCE
A. Provide materials obtained from one source for each type and color of tread specified.

1.03 SUBMITTALS
A. Manufacturer's literature and specifications.

B. Samples showing full range of standard colors, or specific color if indicated.

1.04 DELIVERY, STORAGE AND HANDLING
A. Deliver materials to job site in their original, unopened containers with labels intact. Protect from damage and exposure to elements.

B. Remove damaged or unsuitable materials from the job site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Provide products, as approved by the Architect, by one of the following approved manufacturers:
1. “Tarkett”.

2.02 STAIR TREADS
A. Homogenous thermoset rubber compound, free from embedded foreign material and present a blemish-free surface.

B. Rubber Stair Treads With Integral Riser:
1. Basis of Specification: “Tarkett”, Angle Fit Rubber Stair Treads with Integrated Riser.
2. Type: pre-molded thermoset rubber tread with integral riser.
3. Thickness: 1/8”.
4. Nosing: Square.
5. Surface Texture: Rice Paper.
6. Color: as shown on Drawings.
7. Integrated 2” wide strip of contrasting color.

2.03 PRIMERS
A. Concrete Slab Primers and Sealers:
1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.

2.04 ADHESIVES
A. Provide and install manufacturers recommended adhesive for installation of stair treads. Provide manufacturers nose filler if required.

PART 3 - EXECUTION

3.01 SUBSURFACE

A. Existing surface to be sound, clean, dry and free of foreign matter.

B. Grind smooth any imperfections in concrete preventing tread from resting firmly on surface of stair.

C. Remove existing finishes and adhesives from all stair tread and risers.

3.02 INSTALLATION

A. Field verify all tread dimensions to insure proper items are being installed.

B. Treads shall be carefully fitted in neat and professional manner and free of imperfections and debris.

C. Securely bond with manufacturer's recommended adhesive.

D. Fit nose tightly against and fully adhere to, face of stair riser.

E. Fill any spaces at nosing and stair with manufacturer's recommended stair caulk.

F. Firmly roll all treads until a firm bond has been established.

G. Provide additional fastening strips as required for proper performance and adhesion of materials to the substrate.

SUBMITTAL CHECK LIST

1. Color Samples.
2. Manufacturer's Literature.

END OF SECTION 09 65 13.23

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Section Includes:
   1. Rubber Base.
   2. Vinyl Composition Tile.
   3. Luxury Vinyl Tile.
   4. Thresholds.

B. Furnish labor, materials, equipment, special tools, supervision and services required for floor preparation for tile installation.

C. Furnish labor, materials, equipment, special tools, supervision and services required to install the products and systems complete as shown on the Drawings and/or specified herein.

1.02 SUBMITTALS

A. Manufacturer’s Literature:
   1. Manufacturer's product data and descriptive literature.
   2. Manufacturer's installation instructions.
   3. Manufacturer's maintenance instructions.
   4. Material safety data sheets.

B. Samples:
   1. Flooring:
      a. 3”x3” actual tiles of colors as specified on drawings. Color charts alone are not acceptable.
      b. If color is not specified, submit samples of manufacturer's entire selection.
   2. Base:
      a. Full size sections of colors as specified on drawings. Color charts alone are not acceptable.
      b. If color is not specified, submit samples of manufacturer's entire selection.

1.03 DELIVERY, STORAGE AND HANDLING

A. Receive all products and materials as packaged by the manufacturer with manufacturer's seals and labels intact. Store materials at the job site within the building and in a dry place at least 48 hours before installing flooring materials.

B. Store in space with temperature maintained between 65 degrees F and 90 degrees F.

1.04 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 78 46 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01 78 00 - Closeout Submittals.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:
   1. Rubber Base:
      a. “Tarkett".
      b. “Roppe”

c. “Flexco”, Wallflowers.

2. Luxury Vinyl Tile:
   a. “Interface”

3. Vinyl Composition Tile
   a. “Armstrong”
   b. “Tarkett”

4. Thresholds
   a. “Schluter Systems”

2.02 MATERIALS

A. Rubber Base:
   1. FS SS-W-40A, Type I, TS rubber.
   2. Meets ASTM F-1860, Group 1.
   3. 1/8" thickness, 120' rolls, coved, set-on type.
   4. 4" high unless otherwise shown.
   5. Color: as shown on Drawings.

B. Vinyl Composition Tile:
   1. Type: as shown on Drawings.
   2. Size: 12” x 12”.
   3. Finish: as shown on Drawings.
   4. Color: as shown on Drawings.
   5. 1/8" thickness.
   6. FS SS-T-312B, Type IV.

D. Luxury Vinyl Tile:
   1. Type: as shown on Drawings.
   2. Size: as shown on Drawings.
   3. Finish: as shown on Drawings.
   4. Color: as shown on Drawings.
   5. Wear Layer Thickness: 22 mil.
   6. Overall Thickness: 4.5mm (nominal).
   7. Warranty: 15-year wear warranty.

C. Rubber Base Adhesive:
   1. Comply with recommendations of rubber base manufacturer.

D. Rubber or Vinyl Reducer Strips:
   1. 1-1/2" wide, trim to match tile thickness.
   2. Finish: as selected from manufacturer's entire selection.

E. Metal Edge Strip:

   1. General:

      a. Provide metal edge strip at the transition between the tile flooring to the adjacent flooring.
      b. Equal to : “Schluter Systems” transition and edge strips.

   2. Size and Profile:

      a. Bent angle profile with smooth finished edges.
      b. Configuration as required to provide proper transition between finished surface of tile and that

of the adjacent finished flooring. Refer to transition details on Drawings. Contractor to field verify each condition and notify architect of any conflicts.

c. Height to match the thickness of the tile, with top surface smooth and flush with the tile.

3. Material:

a. White zinc, aluminum or stainless steel.
b. Finish as selected from manufacturer's standard selection.

F. Concrete Slab Primers and Sealers:
1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.
2. Scarify, shot-blast, or sand-blast floor as required at no change in bid price.

G. Leveling Compound:
1. Latex type as recommended by flooring manufacturer.

H. Subfloor Leveler System:
1. Equal to: "Tarkett", Subfloor Leveler System.
2. Resilient PVC gradual sloping ramped wedged materials.
3. Provide slope, profile, and lengths as required for specific condition.

PART 3 - EXECUTION

3.01 PREPARATION

A. Spaces shall be at a minimum temperature of 70 degrees F. Temperature shall be maintained during and 48 hours after installation.

B. Surfaces shall meet the minimum requirements of the manufacturer of the flooring. Do not install directly over plywood. Provide luan underlayment over all plywood decks. Commencement of installation of materials constitutes acceptance of the substrates.

C. Work shall not be started until all items penetrating the flooring have been installed.

D. No flooring shall be installed until the installer has ascertained that the chemical treatment of substrates will not interfere with the successful application of the flooring materials.

E. Spaces in which resilient flooring is being installed shall be closed to traffic or other work.

F. When solvent-based adhesives are used, the space shall be ventilated; use spark proof fans if natural ventilation is inadequate. Prohibit all smoking.

G. Before installing flooring, test concrete floor for excessive moisture by taping an 18" x 18" mat of rubber or vinyl sheet material to floor at edges with masking tape. If condensation is apparent on the underside of the sheet after 24 hours, do not install flooring.

H. Before installing flooring, fill all cracks and holes and level depressions with underlayment compound. Surfaces shall not vary more than 1/8" in 10' in any dimension.

I. Before installing flooring, test concrete floor for acceptable adhesion and bonding of new materials atop

substrate. If proper adhesion and bonding are not apparent, do not install flooring until sealer and primer are applied. Scarify, shot-blast, or sandblast floor if required to install sealer/primer.

J. Install floor tiles wall to wall, under all moveable casework and cabinets, under all open counter areas, and up to fixed equipment and casework.

3.02 INSTALLATION

A. Install flooring and products in accordance with the manufacturer's recommendations.

B. Apply all concrete slab primers and sealers as required to achieve an acceptable substrate for installation of flooring per flooring manufacturer's requirements. Apply when areas are ready or scheduled to receive flooring without delays to the project or schedule, and without any additional costs or change in time. If floor is required to be sandblasted, shot-blasted, scarified, or otherwise prepared, perform this work at no additional cost or change in time. This includes, but is not limited to, floor slabs which are not acceptable due to excessive moisture content.

C. Install subfloor leveler at all doors and openings as required so as to maintain a smooth, flat, and true transition between these flooring materials and adjacent flooring materials.

D. Mix and apply adhesive as recommended by the manufacturer. Lay flooring so that fields or patterns center on areas. Adjust pattern so that edge pieces shall not be less than 1/2 size. Lay flooring true to line, level, and with tight joints. Cut flooring to and around all permanent cabinets and bases. Roll flooring to assure contact and proper adhesion to substrate.

E. Apply wall base to walls, columns, pilasters, casework, and other permanent fixtures in rooms or areas where base is required. Install base in lengths as long as practicable with continuous wrapping outside corners, and miter cut inside corners. Do not use preformed corner pieces.

F. Remove excessive adhesive in accordance with flooring manufacturer's instructions.

G. Install edge strips at termination of flooring where substrate is exposed and extends beyond.

H. Install edge strips at doors, openings, and any and all other junctions of this flooring and adjacent flooring materials. Firmly anchor strips to subfloor with adhesive. Make transition in floor finish at centerline of door bottom or opening through wall.

I. After installation, maintain a minimum space temperature of 55 degrees F.

J. Installation of rubber base at bullnose block:
   1. Applies to all rubber base products designed for square corners, not bullnose type.
   2. Traditional wall base profiles should be able to wrap the radius of the wall surface with no issues, but if issues exist, adhesion is a problem, a short return exists, or profiles are non-standard, then the use of a heat gun and pipe shall be required.
   3. The material shall be draped over the pipe that matches the radius of the wall, then apply heat to the surface until the material softens.
   4. Next the base shall be placed into a container of cold water to change the memory and profile.
   5. Then the pieces shall be cut to the proper and full length of the area and return.
   6. Apply contact adhesive, type as per the manufacturer’s recommendations, for short returns.

3.03 VINYL COMPOSITION TILE AND RUBBER BASE CLEANING

A. Not less than 4 days after flooring installation, clean all new VCT floor tile and base. Wash thoroughly, with a cleaner recommended by the flooring manufacturer, in accordance with flooring manufacturer's

recommendations.

B. Polish all flooring surfaces with wax and mechanical buffer. Apply minimum two (2) coats of wax.

3.04 LUXURY VINYL TILE POST-INSTALLATION/ INITIAL CLEANING

A. Wait 48 hours after flooring installation before performing initial cleaning.
B. Sweep, dust mop or vacuum the floor thoroughly to remove all loose dust, dirt, grit and debris.
C. Remove any dried adhesive residue with a clean cloth dampened with mineral spirits.
D. Wash thoroughly, with a cleaning solution using a pH neutral cleaner in accordance with flooring manufacturer's recommendations. The dilution ratio depends on light to heavy soil conditions.
E. Let cleaning solution dwell for 5 to 15 minutes.
F. Scrub the flooring using **floor scrubber system** equipped with manufacturers recommended pad.
G. Remove the cleaning solution using a wet vacuum.
H. Rinse the floor thoroughly with fresh, clean water.
I. Remove the rinse water and allow the floor to dry completely before allowing foot traffic.
J. Repeat the rinse process if necessary to move any visible haze.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Samples.

END OF SECTION 09 65 19

SECTION 09 68 00 - CARPETING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required for floor preparation for carpet installation.

B. Furnish labor, materials, equipment, special tools, supervision and services required to manufacture, deliver and install all carpet indicated, noted and detailed on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Installer who can demonstrate successful experience with installations on projects of similar size and scope to this project.

B. Requirements and Regulatory Agencies:
   1. Provide carpet and padding which meets the following requirements.
      a. Flame Spread: ASTM E84, 75 or less.
      b. Radiant Panel Test: ASTM E648, .45 watts/CM2, or more.
      c. Smoke Density Test: ASTM E662, 450 or less.
      d. Pill Test: DOC FF-1-70, pass.
      e. Meet local Fire Marshal's requirements.

1.03 SUBMITTALS

A. Samples:
   1. Where colors are specified, submit one full size sample of each color specified.
   2. Where colors are not specified or are specified as "to be selected", submit samples showing manufacturer's full range of standard colors for each type of carpet. Submit additional or larger samples of selected colors upon request.

B. Shop Drawings and Manufacturer's Literature:
   1. Seaming diagram indicating:
      a. Pattern direction.
      b. Location of seams.
      c. Location of edge strips.
      d. Dimensions of carpeted areas.

C. Independent Testing Laboratory Test Reports:
   1. Fire hazard classifications.
   2. Static control.
   3. Construction.

D. Certificates:
   1. Manufacturer's certification that rolls furnished were manufactured in accordance with specification requirements, stating yarn and weight, backing and weight and average tuft bind.
   2. Installer's list of comparable installations

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver:
   1. Deliver carpet in original mill wrappings with register number tabs attached or stenciled on bale.

2. Do not deliver materials until installation is ready to begin.

B. Storage:
1. Store materials in dry, well ventilated space.
2. Do not store carpet rolls on end.

C. Handling:
1. Handle to protect from dirt and stains.

1.05 GUARANTEE / WARRANTY

A. Warrant the following items for the lifetime of the carpet face:
1. Wear: Not abrasively wear more than 10% face yarn weight under normal use.
2. Static Electricity: Maintain specified levels of static electricity generation.
3. Edge ravel: Will not occur under normal use.
4. Delamination: Will not occur under normal use.
5. Tuft Bind: Average face year tuft bind of 20 lbs.; will not zipper, wet or dry.

B. Adjustment:
1. During project guarantee period and within 15 days written notice from Owner or Architect, repair seams, edges and any other irregularity.

1.06 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 78 46 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01 78 00 - Closeout Submittals.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:
1. "Interface."

2.02 CARPET

A. Type:
1. Modular Carpet Tile products as indicated on the Drawings.
2. Modular Walk-off Carpet Tile products as indicated on the Drawings.
3. Colors and patterns as indicated on the Drawings. If not indicated, colors and patterns are to be selected by Architect from manufacturer's entire selection for the specific carpet family specified.

B. Static Electricity Generation (all carpet):
1. Control Fiber: Stainless steel, aluminum, copper, or other metal, blended with carpet fiber, or by specific fiber blend.
2. Maximum 3,000 volts at 20% relative humidity and 70°F temperature, AATCC-134-75.

2.03 INSTALLATION MATERIALS

A. Adhesive:
1. Carpet Adhesive:
a. Per carpet manufacturer for substrate and warranty requirements.
b. Nonflammable.
2. Seam Adhesive:
a. Latex base per carpet manufacturer.

B. Concrete Slab Primers and Sealers:
   1. Where existing substrate is unacceptable for adhesion or bonding of new materials: Provide primers and sealers as required by flooring manufacturer to achieve the proper substrate conditions for installation of flooring.

C. Subfloor Leveler System:
   1. Equal to: “Johnsonite”, Subfloor Leveler System.
   2. Resilient PVC gradual sloping ramped wedged materials.
   3. Provide slope, profile, and lengths as required for specific condition.

D. Seaming Tape:
   1. "Orcon", Super-35.

E. Edge Strips (direct glue-down installation):
   1. Extruded, anodized aluminum bar reducer at exposed edges.
   2. Undercut, flanged.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examination: Examine surfaces scheduled to receive carpeting for:
   1. Defects that will adversely affect the execution and quality of work.
   2. Deviation beyond allowable tolerances for carpet installation over concrete as indicated in Section 03 30 00.

B. Conditions of Surfaces:
   1. Do not install carpet over concrete substrate until concrete has cured minimum of 30 days.
   2. Check floor moisture content. Seal inverted glass tumbler to floor with putty. If condensation forms in 48 hours, do not install carpet.
   3. Do not start until unsatisfactory conditions are corrected.
   4. Install carpeting prior to installation of movable partitions and electrical floor outlets.

C. Prime floor slab as recommended by manufacturer.

D. Apply all concrete slab primers and sealers as required to achieve an acceptable substrate for installation of flooring per flooring manufacturer's requirements. Apply when areas are ready or scheduled to receive flooring without delays to the project or schedule, and without any additional costs or change in time. If floor is required to be sandblasted, shot-blasted, scarified, or otherwise prepared, perform this work at no additional cost or change in time. This includes, but is not limited to, floor slabs which are not acceptable due to excessive moisture content.

3.02 INSTALLATION OF DIRECT GLUE DOWN CARPET

A. Install carpet in accordance with submitted seam diagram, and manufacturer’s instructions.

B. Fit carpet neatly into breaks and recesses, against bases, around pipes and penetrations, under saddles and thresholds, and around permanent cabinets and equipment.

C. Seaming (seams shall be invisible):
   1. Cement seams.
   2. Trim length seams.

3. Coat cut edges with seam adhesive.
4. Layout length of rolls so cross seams do not occur at conspicuous locations, near doors or pivot points.
5. Do not place seams perpendicular to doors or entries.
6. Center seams at doors directly under door.
7. Where seams occur at corridor change of direction, follow wall parallel to carpet direction.
8. Bond all seams at warp line.

D. Application of Adhesive:
1. Mix and apply adhesives in accord with manufacturer's instructions.
2. Do not soil walls, bases, or adjacent areas with adhesive.
3. Promptly remove any spillage.
4. Apply contact or seam adhesive 6 inches wide along carpet edges abutting walls and at cross-seams.

E. Roll carpet to remove air bubbles and insure bond.

F. Install carpeting wall to wall, under all moveable casework and cabinets, under all open counter areas, and up to fixed equipment and casework.

3.03 ADJUST AND CLEAN

A. Cleaning:
1. Remove spots and smears of cement from carpet immediately with solvent or adhesive remover.
2. Remove rubbish, wrapping paper, salvages and scraps less than 2 square feet or less than 8 inches in any dimensions.
3. Upon completion, vacuum with a commercial beater bar type vacuum cleaner.

B. Protection:
1. After each area of carpet has been installed, protect from soiling and damage.
2. The use of tape to hold down floor protection is prohibited.
3. The use of adhesive film floor protection is prohibited.

SUBMITTAL CHECKLIST

1. Samples.
2. Seaming Diagram.
3. Testing Laboratory Reports.
4. Certificate of Manufacturer's Compliance.

END OF SECTION 09 68 00

SECTION 09 72 00.01 - WALLCOVERINGS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of wallcoverings required is indicated on drawings and in schedules.

B. Types of wallcovering to be furnished include the following:
1. Vinyl Wallcovering Type II.

C. See Drawings for types of wallcoverings selected.

1.02 QUALITY ASSURANCE

A. Installer: A firm specializing in wallcovering work with not less than three years of experience in installing wallcovering similar to those required for this project.

B. Deliver materials to project site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade and fire hazard classification.

C. Store materials in original undamaged packages or containers. Do not store rolled goods in upright position. Maintain temperature in storage area above 40°F.

D. Illuminate areas of installation using building=s permanent lighting system; temporary lighting alone will not be acceptable.

1.03 SUBMITTALS

A. Product Data:
1. Manufacturer's product data sheets, cutsheets, specifications and installation instructions.

B. Samples:
1. Submit actual samples of wallcovering selected. If not selected, submit samples for selection by the Architect from manufacturer's entire selection of type indicated.

C. Certificate:
1. Manufacturers shall submit to Architect upon request, a certificate of compliance that wallcovering used meets specification and modifications outlined herein.

1.04 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01781 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01780 - Closeout Submittals.

PART 2 - PRODUCTS

2.01 MATERIAL

A. Vinyl Wallcovering Type II, 20 oz scrim, minimum:
1. Shall meet federal specification CCC-W-408A.
2. Medium Duty, Class A vinyl coated fabric wallcovering for institutional or commercial use must conform in all respects to CFFA Quality Standard for Vinyl Coated Fabric Wallcovering CFFA-W101-A.
3. When tested in accordance with ASTM E-84 Surface Burning Characteristics of Building Materials,

Type II wallcovering must meet the requirements of Class A of NFPA-101, Life Safety Code, with Flame Ratings in the Range of 0-25.

4. This material must meet classifications in accordance with ASTM E-84 tunnel test.

C. Adhesives and Primers:
1. As recommended by manufacturer of wallcovering for specific substrate.

PART 3 - EXECUTION

3.01 PREPARATION

A. Acclimatize wallcovering materials by removing from packaging in area of installation not less than 24 hours before application.

B. Remove switchplates, wall plates, and surface-mounted fixtures in areas where wallcovering is to be applied.

C. Prime and seal substrates in accordance with wallcovering manufacturer=s recommendations for type of substrate. Apply surface sealer to gypsum drywall which will permit subsequent removal of wallcovering without damage to paper facing.

3.02 INSTALLATION

A. Install according to manufacturer=s instructions and recommendations.

B. Place wallcovering panels consecutively in order cut from consecutively numbered rolls, including filing of space above or below openings. Hang by reversing alternate strips except on match patterns. Match color variations as closely as possible.

C. Apply adhesive to back of wallcovering and place in accordance with manufacturer's instructions. Install seams plumb, and at least 6@ away from corners. Horizontal seams are not permitted. Overlap seams and double-cut with straight edge to assure tight closure. Remove air bubbles, wrinkles, blisters and other defects. Cut wallcovering evenly to edges of outlet boxes or support.

D. Trim salvages as required to assure color uniformity and pattern match.

E. Remove excess adhesive along finished seams.

3.03 ADJUST AND CLEAN

A. Replace removed plates and fixtures; verify cut edges of wallcoverings are completely concealed.

B. Remove surplus materials, rubbish, and debris resulting from wallcovering installation upon completion of work, and leave areas of installation in neat, clean condition.

C. Clean wallcovering of all stains, marks and adhesives.

SUBMITTAL CHECK LIST

1. Product Data.
2. Samples.
3. Certificate.

END OF SECTION 09 72 00

SECTION 09 84 00 - ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide and install acoustical wall panels as indicated on Drawings and specified herein.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's published product data sheets, cutsheets, catalog pages and specifications.
   2. Manufacturer’s published installation instructions.
   3. Test reports and acoustical performance data.

B. Shop Drawings:
   1. Show panel sizes, configurations, and anchorage details.

C. Samples:
   1. Where colors are specified, submit one sample of each.
   2. Where colors are not specified, or are specified as "to be selected", submit samples showing manufacturer's full range of standard colors.
   3. Submit additional or larger samples of selected colors upon request.

1.03 HANDLING AND PROTECTION

A. Panels shall be stored in manufacturer’s original containers in dry and protected area.

B. Keep in original packaging while in storage.

C. Store indoors on flat surface off of ground.

D. Cover to avoid damage.

E. Do not place concentrated loads on top to avoid crushing.

1.04 PROJECT CONDITIONS

A. Field verify all dimensions prior to installation.

B. Verify that all surfaces and structures are plumb prior to attachment.

PART 2 - PRODUCTS

2.01 ACOUSTICAL WALL PANELS

A. Provide one of the following approved products:
   1. “Soelberg” Muto, or approved equal.

B. Panel:
   1. 1” thick PET slab.
   2. Surface texture: Smooth.
   3. Size: 48” x 42” Hexagon
   4. NRC: 0.75
   5. ASTM E84 Class A Fire Rated
   6. Colors: See Drawings.

C. Edges:
   1. Square.

D. Profile:
   1. All panels to be custom fabricated per the requirements of the Drawings and Specifications.
   2. Size as indicated on the Drawings.
   3. Shape as indicated on the Drawings.

E. Anchorage:
   1. Wall panels shall be secured to walls using mechanical z-clips.
   2. Type of fasteners shall be as appropriate for the substrate, as determined by the manufacturer.
   3. Anchor per manufacturer, but a shall be secured at the top and bottom edges at a minimum.
   4. Install leveling clip at the bottom edge of all wall panels.
   5. Secure to wall and additional blocking per details on the Drawings, if applicable.

PART 3 - EXECUTION

3.01 PREPARATION

A. Panel installation shall not start until work site is free of all wet and dusty trades.

B. Maintain temperature between 60°F - 85°F for 24 hours prior to installation of panels.

C. Panels shall be installed with all suspension points fully engaged.

D. Confirm panels do not have discoloration prior to installation.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.
3. Samples.

END OF SECTION 09 84 00

SECTION 09 90 00 - PAINTING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Extent of painting work as indicated on the Drawings and specified herein including, but not limited to:
   1. Surface Inspection and Preparation.
   2. Paint System Schedule - Exterior Paint Systems.
   3. Paint System Schedule - Interior Paint Systems.

B. Additional requirements of the work are to include:
   1. Painting and finishing of all interior and exterior items and surfaces throughout the project, except as otherwise indicated. Surface preparation, priming and costs of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.
   2. Field painting of exposed steel and ironwork, and primed metal surfaces of equipment installed under mechanical and electrical, except as otherwise indicated.
   3. Field painting of all exposed interior and exterior structural steel components, whether indicated or not on the Drawings. Includes painting of galvanized components unless noted otherwise.
   4. Painting of exposed mechanical, electrical equipment items as indicated on the Drawings.
   5. Paint exposed surfaces except where natural finish of material is specifically noted as a surface not to be painted. Where items or surfaces are not specifically mentioned, paint same as adjacent similar materials or areas.
   6. "Paint" as used herein generally refers to all coating systems material, including primers, emulsions, enamels, stains, sealers, fillers, and other applied materials whether used as prime, intermediate or finish coat.
   7. Painting and finishing of all EXISTING interior and exterior items and surfaces throughout the project, whether they are or are not currently finished, except as otherwise indicated.

1.02 RELATED WORK

A. Following categories of work are NOT included as part of field-applied finish work specified herein, or are included in other sections of the specifications:
   1. Shop Priming:
      Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, miscellaneous metal, and shop-fabricated or factory-built mechanical and electrical equipment or accessories.
   2. Pre-Finished Items:
      Unless otherwise indicated, do not include painting when factory-finishing or installer finishing is specified for such items including, but not limited to, pre-finished aluminum panels, finished mechanical and electrical equipment, light fixtures, switchgear, distribution cabinets, etc.
   3. Concealed Surfaces:
      Unless otherwise indicated, painting is not required on surfaces in concealed areas and generally inaccessible areas, such as interstitial spaces; however, doors and door frames in these spaces shall be painted.
   4. Finished Metal Surfaces:
      Metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting, unless otherwise indicated.

B. Following areas are to be included as special considerations of areas to NOT receive paint:
   1. Operating parts and labels, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, unless otherwise indicated.
   2. Any code-required labels, such as Underwriter's Laboratories and Factory Mutual, or any equipment identification, performance rating, name or nomenclature plates.

1.03 SUBMITTALS

A. Product Data:
1. Manufacturer's published product data sheets, specifications, materials description and technical information.
2. Manufacturer's published installation and application instructions.
3. Materials Safety and Data Sheets (MSDS).

B. Samples and Draw Downs:
1. If colors and finishes are indicated, submit samples boards (draw downs) for each as selected.
2. If colors are not indicated, they will be selected by the Architect from manufacturer's entire selection. Submit complete range of available paint colors, either in the form of a fan set or individual color chips box set.
3. If finishes are not indicated, they will be selected by the Architect from manufacturer's entire selection.
4. Once colors and finishes have been chosen, submit samples boards for each color selected.
5. Sample boards to be 8-1/2 inch x 11 inch cardstock, painted with actual product of color and finish as selected by the Architect. Submit three (3) of each color as selected.
6. Stain samples to be 6 inch x 6 inch minimum on wood specifies and cut as specified. Submit three (3) of each color as selected.

C. Mock-Ups:
1. Paint on site, a test sample area of wall, 2 foot x 2 foot minimum in size. Complete test area for each color selected, for each paint system specified, and per each substrate material included, as directed by the Architect.
2. Paint one (1) hollow metal door and frame complete, as directed by Architect.
3. Stain one (1) wood door complete, as directed by Architect.
4. Mock-ups shall indicate color, texture and finish.
5. Do not proceed with paint work until mock-ups have been approved by the Architect.
6. If deemed unacceptable by the Architect, create another mock-up to correct items of unacceptability. Continue process until an approved mock-up has been achieved.
7. Once an approved mock-up has been achieved, use as a standard of comparison for all work.
8. Do not destroy or remove mock-up until all paint work is complete and accepted.
9. Accepted mock-ups may remain as part of the work or discarded, at the discretion of the Architect.

D. Compatibility Tests:
1. Paint on site, (2) 2 foot x 2 foot minimum test sample areas of each existing and/or previously painted surface to receive new painted finish atop. Complete test area for each color selected, for each paint system specified, per each existing color of existing surface, and per each substrate material included, as directed by the Architect.
2. Check for compatibility by applying the test sample of the recommended coating system as stated. Allow to dry for one week prior to testing adhesion per procedures of ASTM D3359.
3. Test sample areas are to be completed by the installing contractor, reviewed and checked on site by the paint manufacturer’s representative. If non-compatibility issues exist, the paint manufacturer shall provide recommendations and solutions to compatibility and/or alterations to the paint system specified.
4. Submit all test results and manufacturer’s approval in writing to the Architect. Painting manufacturer must certify that they approve the test results and will include the longevity and performance of the paint system in their warranty and guarantees of the paint system.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site in original, new, sealed and unopened packages and containers bearing manufacturer's name and product label.

B. Store and protect products in strict accordance with manufacturer's recommendations and requirements.

C. Provide physical properties of each product to be used on the project, including:
1. Weight per gallon.
2. Solids by weight.
3. Solids by volume.
4. V.O.C. as supplied.

D. Container labeling to include:
1. Date of manufacture.
2. Manufacturer’s name.
3. Product name, type and stock number.
4. Color and finish.
5. Rate of coverage.
6. Application instructions for surface preparation, drying time, cleanup, mixing and reducing.

E. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in well ventilated area, unless required otherwise by manufacturer’s instructions.

F. Take precautionary measures to prevent fire hazards and spontaneous combustion.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Provide continuous ventilation and heating facilities to maintain surface and ambient temperatures above 50 degrees F for twenty-four (24) hours before, during and forty-eight (48) hours after application of finishes, unless required otherwise by manufacturer’s instructions.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer’s instructions.

C. Minimum Application Temperatures for Latex Paint: 50 degrees F for exterior, unless required otherwise by manufacturer’s instructions.

D. Minimum Application Temperatures for Varnish Finishes: 65 degrees F for interior and exterior, unless required otherwise by manufacturer’s instructions.

E. Provide lighting level of 80 foot candles measured mid-height at substrate surface.

1.06 PROJECT CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding ambient air temperatures are between 60 degrees F and 85 degrees F, for at least 72 hours prior to beginning of installation, unless otherwise permitted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding ambient air temperatures are between 45 degrees F and 95 degrees F, for at least 72 hours prior to beginning of installation, unless otherwise permitted by paint manufacturer's printed instructions.

C. Maintain proper ambient air temperatures throughout entire timeframe of installation and cure period.

D. Do not install until space is enclosed, weathertight, and ambient conditions are controlled and stabilized.

E. Do not apply in snow, rain, fog or mist; or when relative humidity exceeds 85%; or on damp or wet surfaces.

F. Provide adequate ventilation at all times for proper drying.

1.07 MAINTENANCE MATERIALS AND DATA

A. See Specification Section 01 78 46 - Closeout Maintenance Materials.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:
   1. "The Sherwin-Williams Company" (S-W).
   2. "PPG Paints" (PPG).
   3. "Benjamin Moore & Company" (Moore).

2.02 MATERIALS

A. Quality:
   1. Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers.
   2. Materials not displaying manufacturer's identification as a standard, "top-of-the-line" product will not be acceptable.

B. Compatibility:
   1. Provide finish coats which are compatible with prime paints used.
   2. Review other sections of these specifications in which prime paints or factory coats are to be provided to insure compatibility of total coatings systems for various substrates.
   3. Upon request from other trades, furnish information on characteristics of finish materials proposed for use, to insure compatible prime coats are used.
   4. Provide barrier coats over incompatible primers or remove and re-prime as required.
   5. Provide undercoat paint produced by same manufacturer as finish coats. Where undercoats specified are not considered by the paint manufacturer to be fully compatible with the finish coat, submit recommended undercoat substitution to Architect for acceptance. No additional cost to the Owner will be considered for such a change.
   6. Use only thinners approved by the paint manufacturer, and use only within recommended limits.
   7. Notify the Architect in writing of any anticipated problems during bidding with the use of specified coating systems with substrates primed by others.

C. Coatings and Pigments:
   1. To be pure, non-fading, applicable types to suit substrates and service expectations indicated.
   2. Ready mixed, except field catalyzed coating.
   3. Pigments processed to a soft paste consistency, capable of being readily and uniformly dispersed to as a homogeneous coating.
   4. Good flow and brushing properties; capable of drying or curing free of streaks or sags.

D. Accessory Materials:
   1. All materials, such as linseed oil, shellac, turpentine, paint thinners, and other materials not specifically indicated but required to achieve the finishes specified.
   2. All of commercial quality.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine surfaces scheduled to be finished prior to commencement of work.

1. Report any conditions that may potentially affect proper application.
2. Verify that surfaces and substrate conditions are ready to receive work as instructed by the product manufacturer.
3. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film or proper adhesion required.

C. Beginning of installation equates to acceptance of the substrate by the contractor.

3.02 PREPARATION - GENERAL

A. Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.
1. Clean surfaces to be painted before applying paint or surface treatments.
2. Remove oil and grease prior to mechanical cleaning.
3. Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly painted surfaces.

B. Provide all scaffolding and staging required for work in this Section.
1. Coordinate locations to eliminate interference with work of others.

C. Remove hardware, hardware accessories, machined surfaces, electrical plates, lighting fixtures, trim, clocks, speakers, devices, fittings and similar items which are not to be finish-painted, prior to preparing surfaces or finishing.

D. Provide surface-applied protection prior to surface preparation and painting operations for all adjacent areas, surfaces, or items to remain.

E. Correct minor defects and clean surfaces which affect work of this Section.

F. Shellac and seal marks which may bleed through surface finishes.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage, mixing and application of paint in a clean condition, free of foreign materials and residue.

3.04 SURFACE PREPARATION

A. Uncoated Steel and Iron Surfaces:
1. Clean ferrous surfaces, which are not galvanized or shop coated, of oil, grease, dirt, loose mill scale and other foreign substances by solvent or mechanical cleaning.
2. Where heaving coatings of scale are evident, remove by wire brushing or sandblasting; clean by washing with solvent.
3. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned.

B. Shop Primed Steel Surfaces:
1. Sand and scrape to remove loose primer and rust.
2. Feather edges to make touch-up patches inconspicuous.
3. Clean surfaces with solvent.
4. Prime bare steel surfaces.
5. Touch-up shop-applied prime coats wherever damaged or bare, and where required by other

sections of these specifications. Clean and touch-up with same type shop primer.

C. Galvanized Surfaces:
1. Remove surface contamination and oils and wash with non-petroleum based solvent.
2. Apply coat of etching primer.

D. Unit Masonry Surfaces:
1. Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter.
2. Remove oil and grease with a solution of tri-sodium phosphate, rinse well and allow to dry.
3. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water.
4. Allow to dry.

E. Gypsum Board Surfaces:
1. Latex fill minor defects.

F. Plaster Surfaces:
1. Fill hairline cracks, small holes, and imperfections with latex patching plaster.
2. Make smooth and flush with adjacent surfaces.
3. Wash and neutralize high alkali surfaces.

G. Interior Wood Scheduled to Receive Transparent Finish:
1. Remove loose dust, dirt, grit and foreign matter.
2. Set nails and screws.
3. Fill nail and screw holes, cracks and blemishes after staining with filler to match color wood or stain.
4. Sand smooth.

H. Interior Wood Items Scheduled to Receive Paint Finish:
1. Wipe off dust and grit prior to priming.
2. Seal knots, pitch streaks and sappy sections with sealer.
3. Fill nail holes and cracks after primer has dried; sand between coats.

I. Exterior Wood Scheduled to Receive Paint Finish:
1. Remove dust, grit and foreign matter.
2. Seal knots, pitch streaks and sappy sections.
3. Fill nail holes with tinted exterior caulking compound after primer coat has been applied.

J. Exterior Wood Items Scheduled to Receive Stain:
1. Remove greasy residue, mildew, mortar and asphalt smears and construction soil.

K. Wood Doors, Metal Doors and Metal Frames:
1. Apply one coat of paint to glazing stops and rabbets prior to glazing.

L. Insulated Coverings:
1. Remove dirt, grease and oil from canvas and cotton.

M. New Wood:
1. Prime, stain or seal wood required to be job-painted, immediately upon delivery to job.
2. Prime edges, ends, faces, undersides, and backsides of such wood.

N. Existing Wood:
1. Lightly sand and clean to remove dirt, grease, oils, etc.
2. Patch and repair any surface damage prior to re-finishing.

O. Tectum / Cement Composition Panels:
1. Remove all surface contamination by washing with an appropriate cleaner.
2. Rinse thoroughly and allow to dry.
3. Existing peeled or cracked paint shall be scraped and sanded to a sound surface.
4. Pressure clean, if required, with a minimum of 2,100 psi pressure to remove all dirt, dust, grease, oil, loose particles, laitance, foreign material, and peeling or defective coatings. Allow surface to dry.
5. Perform a pH test. The pH of the surface should be between 6 and 9.

P. Previously Coated Surfaces:
1. Maintenance painting will frequently not permit or require complete removal of all old coatings prior to repainting. However, all surface contamination such as oil, grease, loose paint, mill scale, dirt, foreign matter, rust, mold, mildew, mortar, efflorescence and sealers must be removed to assure sound bonding to the tightly adhering old paint.
2. Feather edges of existing coating to make touch-up patches inconspicuous.
3. Glossy surfaces of old paint films must be clean and dull before repainting. Accomplish by sanding or thoroughly washing with an abrasive cleanser.
4. Spot prime any bare areas with an appropriate primer.
5. Provide compatibility tests per submittal requirements herein.
6. If the coating proves incompatible, complete removal is required.

Q. Hand Tool Cleaning:
1. Hand tool cleaning removes all loose mill scale, loose rust, and other detrimental foreign matter. It is not intended that adherent mill scale, rust and paint be removed by this process.
2. Mill scale, rust and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.
3. Prior to hand tool cleaning, remove visible oil, grease, soluble residues and salts by the methods outlined in the “Steel Structures Paint Council Surface Preparation Specification No. 2 (SSPC-SP1 and SSPC-SP2).

3.05 PROTECTION

A. Protect elements surrounding the work of this Section from damage or disfiguration.

B. Repair damage to other surfaces caused by work of this Section.

C. Furnish drop cloths, shields, and protective methods to prevent spray or droppings from disfiguring other surfaces.

D. Remove empty paint containers from site.

3.06 APPLICATION

A. General:
1. Apply paint and coatings in strict accordance with manufacturer's published directions. Apply all coatings at manufacturer’s recommended spreading rates per coat to provide finished wet mil and dry mil coverage per coat between the minimum and maximum microns indicated.
2. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
3. Paint surfaces behind movable equipment same as similar exposed surfaces.
4. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.
5. Sand lightly between each succeeding enamel or varnish coat.
6. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted,

unless otherwise indicated.

B. Scheduling Painting:
1. Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
2. Allow sufficient time between successive coatings to permit proper drying.
3. Do not apply finishes to surfaces that are not dry.

C. Technique:
1. Apply each coat to uniform finish.
2. Apply each coat of paint slightly darker than preceding coat, unless otherwise approved.
3. Sand lightly between coats to achieve required finish.
4. Allow applied coat to dry before next coat is applied.

D. Apply paint as recommended by the manufacturer and as approved by the Architect:
1. Apply final coat to concrete, masonry and smooth finished wall and ceiling surfaces with roller.
2. Apply paint to exposed ceiling surfaces and in inaccessible areas by spraying.
3. Do not use spray application on other areas without written approval of Architect.
4. Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or if not indicated, as recommended by coating manufacturer.

E. Draw lines of demarcation between different shades or colors to eliminate blurred edges.

F. Back-prime all surfaces of interior and exterior wood blocking and woodwork, except pressure treated wood, with one coat of aluminum paint.

G. Prime back surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

H. Where clear finishes are required, tint fillers to match wood.
1. Work fillers into the grain before set.
2. Wipe excess from surface.

I. Coat steel items that come in contact with aluminum items with a field coat of bituminous paint.

J. Mechanical and Electrical Work:
1. Painting of mechanical and electrical work is limited to those items exposed in finished occupied spaces.
2. Mechanical items to be painted include, but are not limited to, ducts, diffusers, piping, pipe hangers, supports and accessory items.
3. Electrical items to be painted include, but are not limited to, the following:
   a. Conduit and fittings (In finished areas only, unless otherwise indicated).
   b. Switchgear (In Finished areas only, unless otherwise indicated).

K. Paint all exposed ceiling construction, including joists, structural members, metal deck and all exposed conduit, pipes, pipe covering and ductwork in these ceiling areas.

L. Seal, stain and varnish concealed and semi-concealed surfaces of millwork items.
1. Seal internal surfaces of millwork items with two coats of shellac.
2. Brush apply only.

M. Prime Coats:
1. Apply prime coat of material which is required to be painted or finished, and which has not been

prime coated by others.
2. Re-coat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects due to insufficient sealing.

N. Pigmented (Opaque) Finishes:
1. Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage.
2. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable.

O. Completed Work:
1. Match approved samples for color, texture and coverage.
2. Remove, refinish or repaint work not in compliance with specified requirements.

P. Renovation and Patching Areas:
1. Prepare and prime new construction portions of surfaces per specifications
2. Prepare existing surfaces located in the same plane as renovation or patching per specifications.
3. Paint area of renovation and patching entire surface full height, from “floor-to-ceiling” and from "corner-to-corner".

3.07 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop primed equipment.

B. Touch up marred or damaged shop prefinished items.

C. Remove unfinished louvers, grilles, covers and access panels on mechanical and electrical components and paint separately.

D. Replace identification markings on mechanical or electrical equipment when painted accidentally.

E. Paint interior surfaces of air ducts and convector and heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit sight line.
1. Paint dampers exposed behind louvers, grilles, and convector and heating to match face panels.

F. Paint exposed conduit and electrical equipment occurring in finished areas.

G. Paint both sides and all edges of plywood backboards for electrical and telephone equipment with one coat of light to medium gray paint before installation of equipment.

H. Reinstall electrical plates, hardware, light fixture trim, clocks, speakers and fittings removed prior to finishing.

I. Paint all equipment located on roofs, including aluminum exhaust fans, gravity relief vents, appliance exhausts and all equipment unless factory finish is acceptable to Architect.

J. Refer to Division 23 and Division 26 for schedule of color coding and identification banding of equipment, ductwork, piping and conduit.

3.08 CLEANING AND PROTECTION

A. As work proceeds, promptly remove paint where spilled, splashed or spattered.

B. During progress of work maintain premises free of unnecessary accumulation of tools, equipment, surplus material and debris.

C. Collect cotton waste, cloths and material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

D. During progress of work remove from site discarded paint materials, rubbish, cans and rags at end of each work day. **DISPOSE OF ALL MATERIALS IN ACCORDANCE WITH FEDERAL, STATE AND LOCAL REGULATIONS.**

E. Upon completion of painting work, clean window glass and other paint-spattered surfaces.

F. Protection:
1. Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting.
2. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.
3. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.09 PAINT SYSTEM SCHEDULE - EXTERIOR PAINT SYSTEMS

A. STEEL, UNPRIMED (exterior, new construction, painted finish):

1st Coat - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*Color selected as most appropriate beneath finish topcoats.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.

B. STEEL, SHOP PRIMED (exterior, new construction, painted finish):

Touch-Up - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*May use original primer if available.
*Color selected as most appropriate to match primer.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.

C. STEEL, GALVANIZED (exterior, new construction, painted finish):

1st Coat - Universal Primer
"S-W, PRO Industrial, Pro-Cryl, Universal Primer, B66A00310"
*Gray.

2nd Coat - 100% Acrylic Emulsion
"S-W, Metalatex, Semi-Gloss Coating, B42W00111"

3rd Coat - 100% Acrylic Emulsion
"S-W, Metalatex, Semi-Gloss Coating, B42W00111"
*Not less than 3.0 mils dry film thickness.

D. STEEL, ALL TYPES (exterior, existing and/or previously painted, painted finish):
1st Coat - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*Color selected as most appropriate beneath finish topcoats.
*Additional coats as required to cover existing color or correct rusting.
*Painter responsible to visit site and field verify surface prep required.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.

E. METAL DOORS AND FRAMES (exterior, new construction, painted finish):
Touch-Up - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*May use original primer if available.
*Color selected as most appropriate to match primer.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.
*Additional coats as required by Architect to achieve desired and intended result.

F. CONCRETE SURFACES (exterior, new construction, painted finish):
1st Coat - Acrylic Block Filler
"S-W, Heavy-Duty Block Filler, Interior/Exterior Acrylic, B42W150"
*Apply filler coat at a rate to ensure complete coverage with pores filled.

2nd Coat - 100% Acrylic Emulsion Topcoat
"S-W, Metalatex, Semi-Gloss Coating, B42 Series"

3rd Coat - 100% Acrylic Emulsion Topcoat
"S-W, Metalatex, Semi-Gloss Coating, B42 Series"

G. CONCRETE SURFACES (exterior, new construction, painted “rubbed” finish):
1st Coat - Surface Prep Conditioning
*Clean and prep all surfaces per topcoat manufacturer and allow to completely dry.
*If pH exceeds 9, treat all surfaces with a 5% solution of muratic acid and water, rinse thoroughly and allow to completely dry.
*Use of a chemical pH reduction product is allowed if compatible with the topcoat.

2nd Coat - 100% Elastomeric Coating
“S-W, Conflex XL, Elastomeric High Build Coating, A5-800 Series”
"Lanco & Harris, Triko-Plex"

*Resulting surface to have 10 or less pinholes per square foot.
*Not less than 12-15 mils dry film thickness.

3rd Coat - 100% Elastomeric Coating
"S-W, Conflex XL, Elastomeric High Build Coating, A5-800 Series"
"Lanco & Harris, Triko-Plex"
*Topcoat finish texture to be selected by Architect from Fine, Medium or Coarse.
*Provide 24"x24" sample boards of each texture for selection of topcoat finish.

*May be used anywhere "rubbed" concrete surfaces are indicated.

H. PVC / PLASTIC / FIBERGLASS (exterior, new construction, painted finish):
1st Coat - Latex Primer
"S-W, PrepRite ProBlock Latex Primer, B51 Series"
*White

2nd Coat - Latex Topcoat
"S-W, A-100 Exterior Latex Satin, A82 Series"

3rd Coat - Latex Topcoat
"S-W, A-100 Exterior Latex Satin, A82 Series"

3.10 PAINT SYSTEM SCHEDULE - INTERIOR PAINT SYSTEMS

A. CONCRETE MASONRY UNITS (interior, new construction, epoxy coating):
1st Coat - Acrylic Block Filler
"S-W, Heavy-Duty Block Filler, Interior/Exterior Acrylic, B42W46"
*Painter responsible to visit site and field verify surface prep required.

2nd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

3rd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

B. CONCRETE MASONRY UNITS (interior, existing and/or previously painted, epoxy coating):
1st Coat - Acrylic Block Filler
"S-W, Heavy-Duty Block Filler, Interior/Exterior Acrylic, B42W46"
*Painter responsible to visit site and field verify surface prep required.
*Additional coats as required to cover existing color and texture.

2nd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

3rd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

C. STEEL, UNPRIMED (interior, new construction, painted finish):
1st Coat - Rust-Inhibitive Metal Primer

"S-W, Kem Bond HS, Universal Metal Primer"
*Color selected as most appropriate beneath finish topcoats.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.

D. STEEL, SHOP PRIMED (interior, new construction, painted finish):
Touch-Up - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*May use original primer if available.
*Color selected as most appropriate to match primer.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.

E. STEEL, GALVANIZED (interior, new construction, painted finish):
1st Coat - Solvent-Based Acrylic Coating
"S-W, Galvite HS, B50WZ30"

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.

F. STEEL, ALL TYPES (interior, existing and/or previously painted, painted finish):
1st Coat - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*Color selected as most appropriate beneath finish topcoats.
*Additional coats as required to cover existing color or correct rusting.
*Painter responsible to visit site and field verify surface prep required.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.

G. METAL DOORS AND FRAMES (interior, new construction, painted finish):
Touch-Up - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*May use original primer if available.
*Color selected as most appropriate to match primer.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.
*Additional coats as required by Architect to achieve desired and intended result.

H. METAL DOORS AND FRAMES (interior, existing and/or previously painted, painted finish):
1st Coat - Rust-Inhibitive Metal Primer
"S-W, Kem Bond HS, Universal Metal Primer"
*Color selected as most appropriate beneath finish topcoats.
*Additional coats as required to cover existing color or correct rusting.
*Painter responsible to visit site and field verify surface prep required.

2nd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"

3rd Coat - Urethane Alkyd Topcoat
"S-W, Industrial Urethane Alkyd Enamel, B54-150 Series, Gloss"
*Not less than 3.0 mils dry film thickness.
*Additional coats as required by Architect to achieve desired and intended result.

I. GYPSUM DRYWALL / PLASTER WALL SURFACES (interior, new construction, epoxy coating):
1st Coat - Latex Primer
"S-W, ProMar 200 Zero VOC, Interior Latex Primer, B28W02600"
*Tinted toward final color.

2nd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

3rd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

J. GYPSUM DRYWALL / PLASTER WALL SURFACES (interior, existing and/or previously painted, epoxy coating):
1st Coat - Latex Primer
"S-W, ProMar 200 Zero VOC, Interior Latex Primer, B28W02600"
*Painter responsible to visit site and field verify surface prep required.
*Additional coats as required to cover existing color and texture.

2nd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

3rd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

K. GYPSUM DRYWALL / PLASTER CEILING AND SOFFIT SURFACES (interior, existing and/or

previously painted, painted finish):

1st Coat - Latex Primer
"S-W, PrepRite ProBloc, Interior/Exterior Latex Primer/Sealer, B28W02600"
*Painter responsible to visit site and field verify surface prep required.
*Additional coats as required to cover existing color and texture.

2nd Coat - Interior Latex Topcoat
"S-W, ProMar 200 Zero VOC, Interior Latex, Flat "

3rd Coat - Interior Latex Topcoat
"S-W, ProMar 200 Zero VOC, Interior Latex, Flat "

L. WOODWORK (interior, existing and/or previously painted, painted finish):

1st Coat - Alkyd Primer
"S-W, ProBlock, Interior Oil-Based Primer, B79W8810"
*Painter responsible to visit site and field verify surface prep required.
*Additional coats as required to cover existing color and texture.

2nd Coat - Interior Latex Topcoat
"S-W, ProClassic Waterborne Interior Acrylic, Semi-Gloss, B31 Series "

3rd Coat - Interior Latex Topcoat
"S-W, ProClassic Waterborne Interior Acrylic, Semi-Gloss, B31 Series "

M. PVC / PLASTIC / FIBERGLASS (interior, new construction, painted finish):

1st Coat - Waterborne Acrylic Primer
"S-W, Multi-Purpose Interior/Exterior Latex Primer Sealer, B51 Series"
* Off White

2nd Coat - Interior Acrylic Topcoat
"S-W, ProClassic Waterborne, Interior Acrylic Enamel Satin, B20 Series"

3rd Coat - Interior Acrylic Topcoat
"S-W, ProClassic Waterborne, Interior Acrylic Enamel Satin, B20 Series"

N. DRY FALL PAINT (interior, new construction, painted finish):

*Used at exposed overhead applications as permitted by the Architect.
1st Coat - Primer
Primer per manufacturer as applicable to substrate materials

2nd Coat - Waterborne Acrylic Dry Fall
"S-W, Dry Fall Flat, B42 Series"
*Brilliant White (B42W81) or Black (B42B81) as directed by the Architect.

3rd Coat - Waterborne Acrylic Dry Fall
"S-W, Dry Fall Flat, B42 Series"
*Brilliant White (B42W81) or Black (B42B81) as directed by the Architect.
*Not less than 4.0 mils dry film thickness.

O. CONCRETE SURFACES (interior, existing and/or previously painted, painted finish):

1st Coat - Acrylic Block Filler
"S-W, Heavy-Duty Block Filler, Interior/Exterior Acrylic, B42W150"

*Painter responsible to visit site and field verify surface prep required.
*Additional coats as required to cover existing color.

2nd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

3rd Coat - 2-Component Epoxy Topcoat
"S-W, Water Based Catalyzed Epoxy, Zero VOC"
B73 Series (Part A and Part B)

P. EXISTING STEEL ROOF BEAMS
(interior, existing and/or previously painted, painted finish):

1st Coat - Universal Primer
"S-W, PRO Industrial, Pro-Cryl, Universal Primer, B66W00310"
*Tint towards final color.
*Spot prime rust areas as required.
*Additional coats as required to cover existing color or correct rusting.
*Painter responsible to visit site and field verify surface prep required.

2nd Coat - Acrylic Topcoat
"S-W, Pro-industrial multisurface Acrylic Eggshell, B66-1560
*Prior to proceeding, a test sample area is required to ensure compatibility.
* Tint base.
*Tinted towards final color.

3rd Coat - Acrylic Topcoat
"S-W, Pro-industrial multisurface Acrylic Eggshell, B66-1560
*Not less than 3.0 mils dry film thickness.

SUBMITTAL CHECKLIST

1. Product Data.
2. Samples and Draw Downs.
3. Mock-Ups.
4. Compatibility Tests.

END OF SECTION 09 90 00

SECTION 10 11 13 – VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to furnish and install all wall-mounted visual display boards as follows:
   1. Markerboards.
   2. Tackboards.

1.02 SUBMITTALS

A. Shop Drawings:
   1. Indicate elevations of all boards and layout/arrangement of boards where multiple exist together.
   2. Indicate size, location, joints, arrangements, and materials.
   3. Indicate section details.
   4. Indicate installation, backing anchorage, and accessories.

B. Maintenance Instructions:
   1. Include in Maintenance Manual, manufacturer’s instructions on cleaning surfaces.

C. Samples:
   1. Markerboard face sheet color samples.
   2. Tackboard surface samples.

1.03 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver material in manufacturer’s original, unopened, undamaged, protective packaging.
   2. Identify package contents by product, size, and location of installation in project.

B. Store materials in manufacturer’s original protective packaging.

C. Protect units from soiling, damage, moisture, and construction activity.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Basis of specification is "Platinum Visual Systems" Model BTS, Box Tray Trim System.

B. Provide materials equal to the above-listed product, as approved by the Architect, by one of the following acceptable manufacturers:
   1. "Claridge"

2.02 MATERIALS

A. Markerboards:
   1. Face Sheet: Porcelain enamel finish, conform to Porcelain Enamel Institute Specifications S-104. Minimum 24 gauge enameling grade steel sheet, magnetic.
   2. Core Material: 7/16” medium density fiberboard hardboard (MDF), or 1/2" particleboard.
   3. Panel Backing: .015" aluminum sheet panel.
   4. Joints: Hairline with continuous 14 ga. metal spline, concealed.
   5. Size: Height x Length as indicated on Drawings.
   6. Colors: White gloss.

B. Tackboards:
1. Surface: Minimum 21 oz. ply self-healing vinyl fabric, coarse linen pattern. Washable and mildew-resistant.
2. Face Sheet: 1/4” self-healing cork.
3. Core Material: 1/4" hardboard.
4. Size: Height x Length as indicated on Drawings.
5. Colors: As selected by Architect from manufacturer’s standard selection.

E. Trim:
1. Provide on all types of visual display boards, entire perimeter, unless specifically indicated otherwise.
2. No trim is required on frameless type tackboards.
3. Extruded aluminum 6063-T5, clear anodized, satin finish.
4. Snap-on type, with clips.
5. Lengths of trim are to be a continuous length piece, without a seam or butt joint. Applies to all edges at entire perimeter of each complete unit; tops, bottoms, and sides of all units. Spliced trim pieces are not acceptable and will be cause for rejection and replacement.

F. Mounting:
1. Provide on all types of visual display boards.
2. Wall attachment hardware, concealed from view, unless specifically indicated otherwise.

G. Accessories:
1. Provide on all markerboards.
2. Marker Tray: Adhesive Backed Marker Tray.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wall-hang units tight and secure to wall surface.

B. Install in strict accordance with manufacturer's instructions.

C. Keep perimeter lines straight, plumb and level, and in plane of wall.

D. Joints, if required, shall be minimal, balanced, symmetrical, and straight.

E. Fit butted joints tightly in same plane.

F. Install anchor clips and brackets min. 16" o.c.

G. Clean to original finish: break in surface if required.

3.02 INSTALLATION SCHEDULE:

A. Install items at 2’-10”, unless noted otherwise. Verify with Architect prior to installation.

SUBMITTAL CHECK LIST
1. Shop Drawings.
2. Maintenance Instructions.
3. Samples.

END OF SECTION 10 11 13

SECTION 10 13 00.02 - INTERIOR SIGNS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Interior signage as indicated on the Drawings and specified herein, including:
   1. Non-illuminated room identification signs.
   2. Non-illuminated dimensional lettering.

1.02 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's product data, cutsheets, specifications and installation details to illustrate conformance with the specifications and for selection and/or verification of all sign layout and construction items.

B. Signage Layout:
   1. Provide initial layout of signage and lettering, including the actual spacing and layout required for the surface to be installed on.
   2. Draw and indicate layout to scale, with field verified measurements included.

C. Mounting Template:
   1. Once a final layout has been approved, supplier shall provide the Contractor with a full scale mounting template for proper positioning of studs and fasteners.

D. Samples:
   1. Submit full size samples of actual sign for each type specified.
   2. Submit full size paper template of dimensional lettering signs.
   3. Submit color charts for color selections.
   4. Submit actual color and finish samples as requested for selection of verification.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver signs in manufacturer's unopened packages, with labels intact.

B. Store and handle letters so as to prevent damage or deterioration.

PART 2 - PRODUCTS

2.01 ROOM IDENTIFICATION SIGNS

A. Typical Flat Wall Signs:
   1. Basis of Specifications: “ASI Sign Systems”, InTouch.

B. Type of Graphics:
   1. .080” thick matt acrylic faceplate laminated to a .080” thick acrylic back.
   2. Raised etched tactile letters welded to front surface of plaque.
   3. Letters and numerals shall also be included in raised braille, color same as background.
   4. Copy to be centered, unless indicated otherwise.
   5. Signs are to be unframed.
   6. Typeface: Uppercase 3/4" high.
   7. Font: As selected from manufacturer’s entire standard selection.
   8. 1/2” Radius Corners.
   9. Size: as shown on Drawings.

2.02 ROOM IDENTIFICATION SIGNS

A. In-House Updatable Flat Wall Signs:
1. Basis of Specifications: “ASI Sign Systems”, Interior 20, Paper-Flex.

B. Type of Graphics (permanent graphic panel):
1. .080” thick matt acrylic faceplate laminated to a .080” thick acrylic back.
2. Raised etched tactile letters welded to front surface of plaque.
3. Letters and numerals shall also be included in raised braille, color same as background.
4. Copy to be centered, unless indicated otherwise.
5. Signs are to be unframed.
6. Typeface: Uppercase 3/4" high.
7. Font: As selected from manufacturer’s entire standard selection.
8. 1/2” Radius Corners.
9. Size: as shown on Drawings.
10. Interchangeable panel area to be a single area or subdivided as per the Architect’s requirements. See details on the Drawings or as specified herein.

C. Type of Graphics (interchangeable panel):
1. Replaceable paper insert within integral place holder guides.
2. Clear panel over changeable graphics window.

2.03 DIMENSIONAL LETTERING (CUT ACRYLIC)

A. Cut Acrylic Letters:
1. Basis of Specifications: “ASI Sign Systems”, LPP Series.

B. Type of Graphics:
1. Precision cut from integrally colored acrylic material.
2. Suitable for both interior and exterior use.
3. Acrylic to be 1/8” thick for letters up to 1” high and 3/16” thick for letters 1-1/4” high or larger.
4. Typeface: Upper and lower case.
5. Font: As selected from manufacturer’s entire standard selection.
6. Text: As indicated on Drawings or Sign Schedule.
7. Size: As indicated on Drawings or Sign Schedule.
8. Finish: Colored Acrylic. Color to be selected from manufacturer’s entire selection.

2.04 COORDINATION

A. Colors shall be selected from manufacturer's entire standard selection, panel and type.

B. Room names and numbers to be determined during shop drawing submittals, unless otherwise indicated.

C. Blank Back Plate:
1. Flat and smooth panel.
2. Material and color to match plaque.
3. Size to match plaque.
4. Provide for any sign where plaques need to be installed on a glass sidelight, transom or window, or where backside and/or mounting is otherwise exposed to view. Provide when and where directed by Architect, whether indicated or not, for location of sign installation designated.

D. Field verify all locations of signs with Architect prior to mounting. Relocate as required.

2.05 TYPES OF SIGNS

A. The following signs shall be provided throughout the project, whether indicated or not:
   1. All restrooms shall be identified by room name, pictogram, and universal symbol of accessibility.
   2. All fire extinguishers shall be identified by universal symbol for extinguisher.
   3. Typical sign elevations may be indicated on Drawings. See miscellaneous details on Drawings.

2.06 SIGN SCHEDULE (ROOM IDENTIFICATION SIGNS)

Architectural Room #	Room/Space	Sign Type	Qty.	Sign Text	Symbol	Remarks
101	Vestibule	E	2	EXIT	N/A	Glass Backers
103	Reception	A	2	MAIN OFFICE	N/A	Glass Backers
105	Office	B	1	GUIDANCE COUNSELOR	N/A	Paper Insert
106	Office	B	1	GUIDANCE COUNSELOR	N/A	Paper Insert
107	Principal	B	1	PRINCIPAL	N/A	Paper Insert
108	Conference	A	1	CONFERENCE	N/A	N/A
109	Work Rm.	C	1	FIRE EXTINGUISHER	Fire Extinguisher	N/A
110	Hall	A	1	MAIN OFFICE	N/A	N/A
111	Records	A	1	RECORDS	N/A	N/A
112	Staff RR	G	1	STAFF RESTROOM	H/C, MAN, WOMAN	N/A
113	Staff RR	G	1	STAFF RESTROOM	H/C, MAN, WOMAN	N/A
116	Work Area	A	1	WORK ROOM	N/A	Glass Backer
117	Office	B	1	OFFICE	N/A	Paper Insert
118	Storage	B	1	OFFICE	N/A	Paper Insert
119	Storage	B	1	OFFICE	N/A	Paper Insert
120	Office	B	1	OFFICE	N/A	Paper Insert
121	Clinic	B	1	NURSES OFFICE	N/A	Paper Insert
122	Clinic RR	F	1	RESTROOM	H/C, MAN, WOMAN	N/A
123	Office	B	1	OFFICE	N/A	Paper Insert
124	RR	H	1	STAFF RESTROOM	MAN, WOMAN	N/A
125	RR	H	1	STAFF RESTROOM	MAN, WOMAN	N/A
133	Cafeteria	D	1	MAX. OCCUPANCY: TBD	N/A	N/A
134	Serving	A	3	SERVING	N/A	N/A
136	Dishwashing	A	1	DISHWASHING	N/A	Mount next to Coiling Counter Door in Cafeteria 133
137	Kitchen	C	1	FIRE EXTINGUISHER	Fire Extinguisher	N/A
141	Office	B	1	OFFICE	N/A	Paper Insert
142	Receiving	E	1	EXIT	N/A	N/A
144	RR	G	1	STAFF RESTROOM	H/C, MAN, WOMAN	N/A

2.07 SIGN SCHEDULE (DIMENSIONAL LETTERING)

A. Location: Reception 103
   Text: NORTH HARRISON
   Size: 8”

B. Location: Reception 103
   Text: ELEMENTARY SCHOOL
   Size: 4”

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install all signs square, plumb, level, and true.

B. Adhesive Attachment:
   1. Install using manufacturer's standard double-click foam tape, or combination of tape and adhesive.
   2. Use for typical installations on gypsum board or like surfaces.

C. Fastener Attachment:
   1. In addition to the adhesive method above, install one screw fastener through face of sign and into the substrate at all corners. Finish paint screw heads to match face of sign.
   2. Use for installations on masonry walls, exterior mounting, epoxy paint or area prone to either wet or vandal conditions.

D. Mount sign on wall adjacent to latch side of door, unless otherwise indicated.
   If wall space does not permit this location, consult Architect for mounting desired.

E. Mounting height shall be 60" above finish floor to centerline of the sign, unless otherwise indicated.

F. Install blank back plate on opposite side of plaque where applicable.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Signage Layout.
3. Mounting Template.
4. Samples.

END OF SECTION 10 13 00.02

SECTION 10 14 16.01 - PLAQUE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to fabricate, deliver and install all plaques as noted and detailed on the Drawings and specified herein.

B. Architect will furnish names and titles of items to be included on plaque during the submittal process.

1.02 SUBMITTALS

A. Submit manufacturer's product data, cutsheets and specifications to illustrate conformance with the specifications and for selection and/or verification of all plaque layout and construction items.

B. Provide initial layout of plaque, by including the required identification information herein, so as to provide a proofing copy for review and revision by the Architect. Revise as required until an approved layout and scope of included information is obtained.

C. Once a final layout has been approved, supplier shall provide the Contractor with a full scale mounting template for proper positioning of studs and fasteners.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Plaque:

1.	Material:	Cast Aluminum or Cast Bronze, as selected by Architect.
2.	Size:	18" x 24", oriented horizontally or vertically.
3.	Border:	Standard raised double line.
4.	Background Texture:	Sand, Stipple, or Leatherette, as selected by Architect.
5.	Font:	Selected by Architect from all manufacturer's standard fonts.
6.	Typestyle:	Raised copy, 1/2" size minimum, headings bold type, all others regular type.
7.	Background Finish:	Painted, to be selected by Architect from all manufacturer's standard colors.
8.	Edge Color:	Same as background.
9.	Text/Border Finish:	Satin.
10.	Layout:	Centered.
11.	Mounting:	Blind mount with concealed studs or fasteners.

B. Identification:

1. Name of Project.
2. Names of Owners.
3. Name of Architect.
4. Name of Engineers.
5. Name of Prime Contractors.
6. Date of Project.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount flush to wall with boss and stud concealed type mounting. Utilize manufacturer's mounting hardware as required for the type of wall surface and substrate at area of mounting. Drill hole in wall

substrate and fill with silicone or construction adhesive as per the manufacturer's requirements.

B. Mounting Height: 6'-0" to top from floor.

C. Mount in location as directed by Architect. Verify final mounting location prior to permanent install.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Plaque Layout.
3. Mounting Template.

END OF SECTION 10 14 16

SECTION 10 21 23 - PRIVACY CURTAINS AND TRACKS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide privacy curtains and tracks as indicated on the Drawings and specified herein.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data sheets, cutsheets, specifications, materials description, installation and maintenance instructions.

B. Shop Drawings:
   1. Show proposed method of installation, anchoring and interface between the work of this Section and the work of adjacent trades.

C. Samples:
   1. Actual samples of all items needed for color selections.
   2. Samples of components such as tracks, rollers, fasteners, etc., as required.

1.03 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:
   1. "Salsbury Industries"
   2. "Creative Healthcare Products"
   3. "General Cubicle Co., Inc."
   4. "Imperial"
   5. "A.R. Nelso Co. – Arnco"
   6. "TSM"
   7. “OB/Masco”
   8. “Cavoc Corporation”

2.02 PRIVACY CURTAINS

A. Basis of Specification:
   “Maharam”, Mist 511524.

B. Description:
   1. Inherently and permanently flame resistant meeting NFPA #701.
   2. Include 20 inch high, flame retardant, integral mesh with 1/2 inch openings, attached to the fabric with a 3/4 inch double needle, clean finished lap seam.
   3. Top hem is 1 inch triple folded header with integral rust-proof grommets at 6 inches o.c.
   4. Bottom hem is 1-1/2 inches wide double thick lock stitched.
   5. Side hems are 1/2 inch wide double thick single lock stitched.
   6. Vertical seams are 1/2 inch wide double-turned double-lock stitched.
   7. Weight of 12 ounces per linear yard.

2.03 PRIVACY CURTAIN TRACKS

A. Basis of Specification:
"Salsbury Industries", #19200 series aluminum, ceiling-mounted track and roller curtain carrier.

B. Ceiling-Mounted Track:
1. Basis of Specification:
"Salsbury Industries" #19201 series.
2. Anodized aluminum extrusion, 1" wide x 1-3/4" high x .070".
3. Provide complete with all required and necessary fittings and accessories, in the arrangements and dimensions as indicated on the Drawings.
4. 12 inch radius corner bends, unless shown otherwise.

C. Roller Curtain Carriers:
1. Basis of Specification:
"Salsbury Industries" #19203 series.
2. Self-lubricating nylon body inserted within the extrusion profile to glide along the inside edges of the track channel. Surrounded by a rubber bumper ring to reduce noise. Includes an attached nickel plated steel bead chain connected to a stainless steel hook.
3. Provide quantity of hooks needed to provide equal and proper support of curtain in the arrangement and layout indicated. Provide chain length as required for proper installation and heights.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until satisfactory conditions are corrected.

3.02 INSTALLATION

A. Install all tracks where indicated on the Drawings and in full accordance with the manufacturer's recommendations, anchoring all components as per the manufacturer's recommendations.

B. Coordination with all other trades as required to ensure proper and adequate provision in framing and ceiling finish for the installation of the tracks in the locations required.

C. Drill through center of the track at 16 inches o.c. maximum spacing to accommodate fasteners as required to secure track flush to finished ceiling. Provide fasteners at all ends of all potions and pieces of track.

D. Head of screw fasteners used are to be no longer than a #12 pan head to allow the carriers to clear.

E. Provide solid blocking above finished ceiling as required for fastener locations.

F. All fasteners to be stainless steel.

3.03 INSPECTION AND ADJUSTMENTS

A. Adjust all components for proper alignment and use.

B. Clean and repair all marks, abrasions and scratches to make them completely invisible.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.
3. Samples.

END OF SECTION 10 21 23

SECTION 10 26 13 – WALL AND CORNER GUARDS

PART 1 – GENERAL

1.01 WORK INCLUDED
A. Extent of wall and corner guards as indicated on Drawings and specified herein.

1.02 QUALITY ASSURANCE
A. Deliver materials to project site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade and fire hazard classification.

B. Store materials in original undamaged packages or containers. Store materials in a clean, dry location protected against damage of any kind.

C. Illuminate areas of installation using building's permanent lighting system; temporary lighting alone will not be acceptable.

1.03 SUBMITTALS
A. Product Data:
1. Manufacturer's product data sheets, cutsheets, specifications and installation instructions.
2. Include data on physical characteristics, durability, fade resistance and flame resistance characteristics.

B. Samples:
1. Submit actual samples of corner guards selected. If color not selected, submit samples for selection by the Architect from manufacturer's entire selection of type indicated. Printed color chart alone in not acceptable.

1.04 WARRANTY
A. Provide manufacturer's standard 5-year warranty.

PART 2 – PRODUCTS

2.01 MATERIAL
A. Provide one of the following approved products as indicated on the Drawings:

1. Surface-mounted Corner Guards:
"Pawling"; Impact Protection Systems-Corner Guard, CG-135.
"In Pro Architectural Products"; 130 High Impact Corner Guard.

b. Description:
1. Snap-on extruded vinyl corner guards with continuous aluminum retainer.
2. Dimensions: Leg length: 3", Angle: 135 degrees w/ 1/4" radius.
3. Height: 4'-0".
4. Profile: High-impact vinyl acrylic extrusion with rounded corners.
5. Thickness: nominal .100".
6. Flame Resistance: Class A fire rating (ASTM E 84).
7. Texture: Pebble.
8. Provide injection-molded top and bottom caps.

2. Surface-mounted Corner Guards:

"Koroseal Wall Protection Systems"; Korogard G100 Vinyl Corner Guards.
"Pawling;" Impact Protection Systems-Corner Guard, CG-20.
"Construction Specialties;" Acrovyn Corner Guard, SSM-20AN
"In Pro Architectural Products"; 160 High Impact Corner Guard

a. Description:
   1. Snap-on extruded vinyl corner guards with continuous aluminum retainer.
   2. Dimensions: Leg length: 2", Angle: 90 degrees w/ 1/4" radius.
   3. Height: As noted on Drawings.
   4. Profile: High-impact vinyl acrylic extrusion with rounded corners.
   5. Thickness: nominal .080".
   6. Flame Resistance: Class A fire rating (ASTM E 84).
   7. Texture: Pebble.
   8. Provide injection-molded top and bottom caps.

3. Surface-mounted Corner Guards:
   "Inpro" Clear Corner Guards
   a. Description:
      1. Extruded polycarbonate corner guards adhered to substrate corner with fasteners.
      2. Exposed surfaces shall be free of wrinkling, chipping, discoloration, or other imperfections
      3. Dimensions: Leg length: 3/4", Angle: 90 degrees.
      3. Height: 8' Contractor to field cut height to match height of opening.
      4. Thickness: nominal .050".
      5. Flame Resistance: Class I fire rating, when tested in accordance with ASTM E 84.
      6. Texture: Smooth.
      7. Location: Install in Reception 103 to protect edge of wallcovering.

PART 3 – EXECUTION

3.01 PREPARATION

A. Verify that wall surfaces are acceptable to receive the specified guard systems. Do not begin installation until acceptable conditions have been corrected.

3.02 INSTALLATION

A. Install Corner Guards securely to wall according to manufacturer's instructions and recommendations.

B. Install Corner Guards accurately in location, alignment, and elevation.

C. Install Corner Guards full height of door opening or wall opening, unless indicated otherwise. If desired by the Architect in the field, field cut units to lesser height within openings.

D. Remove excess adhesive along edges.

3.03 ADJUST AND CLEAN

A. Remove surplus materials, rubbish, and debris resulting from corner guard installation upon completion of work, and leave areas of installation in neat, clean condition.

B. Clean corner guards and adjacent wall surfaces of all stains, marks and adhesives.

SUBMITTAL CHECK LIST

1. Product Data.
2. Samples.

END OF SECTION 10 26 13

SECTION 10 28 13 - TOILET ACCESSORIES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Toilet accessories as shown on Drawings and specified herein.

B. Installation of owner-furnished toilet accessories as shown on Drawings and specified herein.

1.02 SUBMITTALS

A. Manufacturer's Literature:
   1. Submit manufacturer's "cut sheets" for each item specified, showing installation details, and product information.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job with manufacturer's unopened packages, with label in tact.

B. Store and handle products so as to avoid damage. Remove all damaged items from the job site.

C. Maintain protective covers until Substantial Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following manufacturers:
   1. "Bobrick"
   2. "Bradley"
   3. "ASI"
   4. "AJW Architectural Products"

B. See Specifications Section 01 62 00 - Product Options and Substitutions.

2.02 MATERIALS

A. Grab Bars:
   1. "Bobrick" B-6806 Series.
   2. Surface mounted, stainless steel, safety grip finish, concealed mounting, snap-flange cover.
   3. Provide 1-1/2" diameter x sizes and configurations as shown on Drawings.
   4. Provide at locations as shown on Drawings, or if not shown, provide as follows:
      a. 36" long horizontally on rear wall of all ADA stalls.
      b. 42" long horizontally on side wall of all ADA stalls and ambulatory stalls.
      c. 18" long vertically on side wall of all ADA stalls and ambulatory stalls.
      d. L-shaped horizontal, 2-wall bar configuration at all ADA shower stall locations. Need not provide if supplied as integral to a shower stall unit. See Plumbing. 19-3/4"x34-3/4" overall for 36"x36" stalls, 40"x58" nominal overall for roll-in stalls.

B. Sanitary Napkin Disposals:
   1. "Bobrick" B-270, "Contura" Series.
   2. Surface-mounted, stainless steel, satin finish.
   3. Provide at locations as shown on Drawings, or if not shown, provide one per female water closet.
   4. Coordinate location with partition door and other accessories.

C. Mirrors:
1. “Bobrick” B-165 Series.
2. 1/4” select float glass mirror with stainless steel angle frames.
3. Corners welded, ground and polished smooth.
4. Surface mounted, stainless steel, satin finish, concealed fasteners.
5. Install centered on lavatory or sink.
6. Provide sizes as shown on Drawings, or if not shown, provide 24"x36".
7. Provide at locations as shown on Drawings, or if not shown, provide one per lavatory or sink.

D. Robe / Coat / Towel Hooks (Single Hook):
1. “Bobrick” B-76717.
2. Surface mounted, stainless steel, satin finish, concealed mounting.
3. Provide at locations as shown on Drawings.
4. Provide one on inside of each toilet partition stall door if partitions do not already include one.

PART 3 - EXECUTION

3.01 PREPARATION

A. Finish surfaces shall be complete prior to installation of accessories.

B. Verify all materials that anchoring devices are compatible with accessories.

3.02 INSTALLATION

A. Drill holes of proper size for required anchoring devices to be concealed in finish wall behind accessories.

B. Install accessories plumb and true.

C. Grab Bars:
1. Anchor grab bars on wall and partition of end toilet compartment and at urinals indicated.
2. Install as recommended by manufacturer to withstand 500lb. downward pull.

3.03 MOUNTING HEIGHTS

A. See Drawings for mounting heights.

B. If not shown on Drawings, confer with Architect for heights required.

C. All mounting heights shall meet all current Codes and ADA requirements.

3.04 ADJUSTING AND CLEANING

A. Check operation of accessories; make final adjustment as required.

B. Remove protective covers.

C. Clean stainless steel of all paints, and other markings, with mild detergent and water.

3.05 PROTECTION

A. Protect accessories from damage until Substantial Completion.

B. Replace any damaged accessories.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.

END OF SECTION 10 28 13

SECTION 10 28 40 - ELECTRIC DRYERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Electric hand and hair dryers as shown on Drawings and specified herein.

1.02 SUBMITTALS

A. Manufacturer's Literature:
   1. Submit manufacturer's "cut sheets" for each item specified, showing installation details, and product information.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job with manufacturer's unopened packages, with label in tact.

B. Store and handle products so as to avoid damage. Remove all damaged items from the job site.

C. Maintain protective covers until Substantial Completion.

1.04 QUALITY CONTROL

A. All equipment shall be UL Listed for application used.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following manufacturers:
   1. "Excel Dryer".
   2. "World Dryer".
   3. "Bobrick".
   4. "American Dryer".
   5. "Toto".
   6. "Saniflow".
   7. "Bradley".

B. See Specifications Section 01 62 00 - Product Options and Substitutions.

2.02 ELECTRIC HAND DRYERS (HIGH-VELOCITY TYPE)

A. Automatic, High Speed, ADA Compliant:
   1. Provide one of the following approved products, or approved equivalent:
      a. "World Dryer", VERDEdri
      b. "Dyson", Airblade V
      c. "Saniflow", Speedflow Plus M17
   2. 12-second dry time.
   3. Surface-mounted or semi-recessed to meet 4" maximum ADA compliant depth.
   4. HEPA filter.
   5. Automatic touch free infrared activation.
   6. Painted finish; color to be selected from manufacturer's entire line.
   7. Universal Voltage or available in 120V, 208V, 240V; verify on Drawings.
   8. Provide at locations as shown on Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Finish surfaces shall be complete prior to installation.

B. Verify all anchoring and supports are in place and properly installed.

C. Verify all electrical rough-ins are in place and properly installed for surface-mounted units to be installed atop concealed junction box.

3.02 INSTALLATION

A. Install as recommended by manufacturer's published information.

B. Install level, plumb and true.

3.03 MOUNTING HEIGHTS

A. See Drawings for mounting heights.

B. If not shown on Drawings, confer with Architect for heights required.

C. All mounting heights shall meet all current Codes and ADA requirements.

3.04 ADJUSTING AND CLEANING

A. Check operation of units; make final adjustment as required.

B. Remove protective covers.

C. Clean stainless steel of all paints, and other markings, with mild detergent and water.

3.05 PROTECTION

A. Protect from damage until Substantial Completion.

B. Replace any damaged units.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.

END OF SECTION 10 28 40

SECTION 10 44 00 - FIRE EXTINGUISHERS AND CABINETS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Fire extinguishers, cabinets, and brackets as shown on the Drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Provide fire extinguishers which are U.L. listed and bear U.L. "Listing Mark" for type, rating, and classification of extinguisher indicated.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data sheets, cutsheets, specifications, materials description, installation and maintenance instructions.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job in manufacturer's unopened packages with labels intact.

B. Store and handle products so as to prevent damage. Remove all damaged items from the job site.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fire Extinguishers:
   1. Kitchen Type:
      a. Basis of Specification: "JL Industries, Inc." Saturn 15.
      b. Fire Class: K.
      c. U.L. Rating: K.
      d. Capacity: 6 liters.

B. Fire Extinguisher Cabinets:
   1. Use with Kitchen Type Extinguishers (Semi-Recessed Mounted):
      a. Basis of Specification: "JL Industries, Inc." Academy.
      b. Tub: Cold rolled steel with white powder coat finish.
      c. Trim: Semi-recessed 1-1/4” square-edge trim, aluminum, clear anodized finish.
      d. Door Style: Full glazing.
      e. Door Glazing: Clear acrylic with red vertical FE lettering.
      f. Hardware: Continuous hinge, roller catch, pull handle. Match trim finish.
   2. Provide fire rated cabinets at all Rated Walls and Smoke Partitions.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install extinguishers in cabinets and on brackets as indicated on the Drawings.

B. Install cabinets and brackets square and plumb, and in accordance with manufacturer's instructions.

C. Install in compliance with all applicable Federal, State, and local regulations.

D. Install cabinets recessed in masonry and stud framed walls as applicable.

E. Locate wall brackets as indicated. Provide blocking as required for all attachment locations.

F. Install cabinets and brackets so as to locate extinguishers at a height of 3'-8" from floor to top of extinguisher handle (for bracket mounted extinguishers) and to center of door pull (for extinguishers in a cabinet), unless otherwise indicated on the Drawings.

3.02 ADJUSTING AND CLEANING

A. Check extinguishers for proper charge in operation.

B. Assure that all doors and hardware operate smoothly and freely.

C. Adjust or replace defective items as required.

3.03 PROTECTION

A. Protect cabinets and extinguishers from damage and deterioration until time of Substantial Completion. Touch up any marred surfaces.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 10 44 00

SECTION 10 51 00.01 - LOCKERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Lockers as indicated on the Drawings and specified herein, of the following types:
   1. Solid Plastic Lockers.

1.02 SUBMITTALS

A. Shop Drawings:
   1. Indicate sizes, dimensions, gauges, construction, trim, finish and hardware.
   2. Indicate locker numbering sequence.

B. Samples:
   1. Where colors are specified, submit one sample of each color.
   2. Where colors are not specified, or are specified as "to be selected", submit samples showing manufacturer's full range of standard colors for each type.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver fully assembled units to site in undamaged condition, with labels intact.

B. Store and handle materials to avoid damage and exposure to elements. Remove damaged otherwise unsuitable material from job site.

1.04 PROJECT CONDITIONS

A. Do not install lockers until space is enclosed and weather-proof, and until wet-work in space is completed, and until temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

PART 2 - PRODUCTS

2.01 SOLID PLASTIC LOCKERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:
   1. “Scranton Products” (Santana - Comtec - Capitol)
   2. “Bradley”
   3. “ASI”

B. Type and Size:
   1. Basis of specification: “Bradley”; “Lenox Lockers”
   2. Width x depth x height as indicated on Drawings.
   3. If not indicated, provide 12" wide x 12" deep x 72" high, 2-tier.

C. Doors:
   1. High impact, high density polyethylene.
   2. 1/2" thick.
   3. Homogeneous color throughout.
   4. Full lattice venting.

D. Sides, Tops, Bottoms, Back and Shelves:
   1. High impact high density polyethylene.
   2. 3/8" thick.

3. Homogeneous color throughout.

E. Components:
1. Machined edges to accept assembly brackets.

F. Hinge:
1. Continuous, full length.
2. PVC plastic with no metal parts.
3. Provide at each opening location.

G. Latch:
1. Continuous PVC plastic.
2. Snap-fit connection.
3. Provide at each opening location.

H. Hooks:
1. 3 total, 1 located on each side and back.
2. Provide at each opening location.

I. Number Plate:
1. Riveted.
2. Numbered in sequence.
3. Provide at each opening location.

J. Locking Device:
1. Architect to select locking during shop drawing submittals.
2. Built-in combination lock.
3. Built-in key lock.
4. Built-in hasp for removable padlock.
5. Provide at each opening location.

K. Finish:
1. Doors, accessories and all exposed surfaces: Integrally colored, solid through body.
2. Body and concealed surfaces: Integrally colored white.
3. Smooth "Orange Peel".
4. Color as indicated on drawings, or as selected from manufacturer's entire selection.

L. Handicapped Accessible Lockers:
1. Provide at locations as indicated on the Drawings or if not indicated, provide a minimum of 5% but not less than one of each type specified.
2. Manufacturer is responsible to provide all modifications as required to meet all requirements of the accessibility Code and ADA.
3. Provide all items within reach heights required.
4. Provide accessible access control for entry into door without use of combination lock. May be accomplished via key fob, card swipe or other method as approved by the Architect.
5. Provide universal symbol of accessibility on exterior of locker to identify locker meeting these requirements for use by disabled students.

2.02 FABRICATION

A. Square and rigid.

B. Interlocked intermediate cross members.

C. All steel to have one-coat electroplated zinc carbon primer. Finish coat as specified.

D. Fabricate filler panels from same material as locker units.

PART 3 - EXECUTION

3.01 PREPARATION

A. Field verify all dimensions prior to fabrication.

3.02 INSTALLATION

A. Install lockers in accordance with manufacturer's instructions and shop drawings.

B. Provide all anchor bolts and other fasteners as required.

C. Provide manufacturer's standard trim at bottom and sides.

D. Provide filler panels as required.

3.03 ADJUSTING AND CLEANING

A. Adjust hardware to insure that all doors operate smoothly.

B. Clean lockers according to manufacturer's recommendations.

3.04 PROTECTION

A. Protect lockers from damage and deterioration until Substantial completion.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Samples.

END OF SECTION 10 51 00.01

SECTION 11 13 00 - LOADING DOCK EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Loading Dock Equipment as shown on the Drawings and specified herein, including:
   1. Edge-of-Dock Leveler.

1.02 QUALITY ASSURANCE

A. Provide mechanical levelers from one manufacturer.

B. Drawings are based on products of one manufacturer. Field coordinate all dimensions, rough openings, power requirements and cast-in-place items with selected manufacturer's product.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Indicate dimensions, part, critical installation clearances and anchorage.

B. Installation Instructions.

C. Manufacturer's Warranty:
   1. Cover all defects in workmanship or materials for a period of 5 years.
   2. Replace or make all corrections at no additional costs to the Owner.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle products so as to prevent damage and deterioration.

PART 2 - PRODUCTS

2.01 EDGE-OF-DOCK LEVELER

A. Basis of specifications:
   1. "Bondor Manufacturing Company", #DL-78
   2. Mechanically operated unit.
   3. Rated capacity of 20,000 lbs
   4. Size: 78" deck width and 116" total width
   5. 15" bumper projection
   6. Working range of 5" above and 5" below dock

B. Description:
   1. Surface mounted unit to dock face to manufacturer's edge anchoring channel, 8" min face.
   2. Dual extension spring lift mechanism
   3. Milled lip edge for smooth tire rollover
   4. Stainless steel hinge pin with greased fittings
   5. 70,000 psi high-strength steel safety tread plate
   6. Secondary gussets
   7. Heavy-duty 5/16" steel bumper blocks with 4" x 12" x 13" standard bumpers

C. Accessories:
   1. Provide manufacturer's edge anchoring channel to embed into dock face concrete and accept edge-of-dock leveler welded to it.
   2. Provide anchoring hooks or straps per manufacturer's standard design

PART 3 - EXECUTION

3.01 PREPARATION

A. Field verify all rough dimensions and cast-in place anchors with manufacturer's specific product.

3.02 INSTALLATION

A. Install in strict accordance with the manufacturer's instructions.

B. Edge-Of-Dock Leveler:
   1. Install manufacturer's edge anchoring channel embedded and cast into concrete dock surface
   2. Weld leveler unit to embedded channel

C. Provide final inspection by manufacturer's representative.
Correct all deficiencies at no additional cost to the Owner.

D. Provide final inspection by manufacturer's representative.
Correct all deficiencies at no additional cost to the Owner.

E. Turn over installation instructions and signed warranty to the Owner.

SUBMITTAL CHECKLIST

1. Shop Drawings.
2. Installation Instructions.
3. Manufacturer's Warranty.

END OF SECTION 11 13 00

SECTION 11 40 00 - FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The furnishing, delivery to the building, uncrating, setting in place, leveling and scribing to the walls or floor, utilities, rough-ins, installation and connections, as required, all food service equipment as shown on the Drawings or specified herein.

B. Food Service Equipment Contractor (FSEC) refers to the person, company or corporation who is contracting the work of the section.

C. The furnishing of all electrical service fixtures directly attached to the equipment, as required.

D. The FSEC shall check the equipment in the field and will be held responsible for the proper utilities, rough-ins and connections to such equipment. The FSEC shall verify to make, model number and size of the equipment and make provisions on the rough-in drawing and shop drawing for these items.

E. When work covered by this specification connects to equipment furnished by others, the FSEC shall check the equipment in the field and will be held responsible for the proper utilities, rough-ins and connections to such equipment. When an item is called out to be "By Owner", the FSEC shall verify to make, model number and size of the equipment and make provisions on the rough-in drawing and shop drawing for these items.

F. Provide kitchen exhaust hood, make-up air and all associated equipment, ductwork, fire protection, components and connections for a fully functional and integrated kitchen exhaust hood system.

G. The food service equipment, kitchen exhaust hood system and dishwash exhaust system are indicated on the Kitchen Equipment Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. Plumbing:
1. Roughing-in all required services.
2. Furnish and install all piping, traps, tailpieces, loop vents, stops, and related items necessary to make the final connections from the rough-in to the equipment.
3. Install the following items which are furnished by the FSEC: faucets, disposers, vacuum breakers, solenoid valves, check valves, pre-rinse assemblies, hose stations, pot fillers, flow control valves, pressure reducing valves, cooling system for waste water above 110° F, filters, controls panels and related items.

B. Electrical:
1. Roughing-in all required services.
2. All final connections from point of rough-in shown on the plans and specifications to the connection points on the equipment indicated on plan and specified herein.
3. Furnish and install all conduit, wire, flexible conduit, cover plates, fittings as required to make provide service to point of disconnect.
4. Install disconnects, plugs, chords, furnished by FSEC to make final connections to equipment.

1.03 QUALITY ASSURANCE

A. All equipment installed under these specifications shall be manufactured and installed in strict compliance with all codes regulations, and requirements of the State Board of Health and all local Health and Sanitation Authorities, and the National Sanitation Foundation Standard #2. The Contractor shall

arrange an inspection by a representative of the Indiana State Board of Health for inspection of the completed food service equipment installation. A "satisfactory report" must be received by the Owner from the State and local Boards of Health before final payment will be approved.

B. All electric equipment shall conform to the standards of NEMA and shall be UL approved, where applicable standards have been set, or otherwise conform to the jurisdictional authorities.

C. Fabricated equipment, described in the following itemized specifications, is required to be manufactured by one equipment manufacturer, who has the facilities to detail, and fabricate highest quality equipment in strict compliance with appropriate standards of NSF.

D. All equipment shall carry a nameplate identifying the manufacturer and all pertinent utility information.

E. All equipment shall be as specifically specified herein or as indicated and detailed on the drawings. Any desired substitutions or review of equivalency of equipment items must be approved by the Architect prior to bids in accordance with Section 01630 -Product Options and Substitutions.

1.04 SUBMITTALS

A. Equipment Brochures:
   1. Shall include FSEC name and address, project name and location, manufacturer's data illustrations, specifications, line drawings, rough-in requirements, plumbing and wiring schematics and a list of the following information will be submitted in a neat and orderly fashion:
      a. Item number, manufacturer and model number.
      b. Description and dimensions.
      c. Size, number and temperature of each water line.
      d. Size, number and pressure of each steam line.
      e. Size, number and CFM for each ventilation outlet.
      f. Electrical circuits, number, voltage, phase, horsepower (HP), amperage (AMP), or kilowatts (KW) of each.
      g. Disconnect size, manufacturer and model number.
      h. Accessories: Include all extra, non-standard equipment.

B. Shop Drawings:
   1. Equipment fabricator shop drawings prepared on a 3/4" = 1'-0" scale.
   2. All necessary cross-section drawings - scale at 1-1/2" = 1'-0".
   3. Show details of all trim required for any equipment and any special construction features.

C. Rough-In Drawings:
   1. Minimum scale of 1/2" = 1'-0" (1/4" is not acceptable).
   2. Show dimensioned locations, heights, sizes and capacities of all mechanical, electrical and ventilating services required for each item of equipment specified and/or shown on drawings, either new or reused, and/or designated as a future item.
   3. Location details: Show exact locations required in the field for other trades to stub-up, stub-down, or stub-out.
   4. Rough-ins shall be located within a wall wherever possible, as high as possible and so as not to conflict with construction or function of building and equipment.
   5. Mechanical and electrical services: Show both services on sheet with outline of each piece of specified equipment shown lightly in proper location.
   6. Locate drains so as to allow for swing of traps.
   7. Interplumbing/interwiring: Show services to allow for interplumbing and/or interwiring of all equipment specified.
   8. Duct openings: Include dimensioned layouts of all duct openings associated with hoods,

dishmachines, etc., as well as ID, size and CFM of said ducts.

9. Include a separate sheet of dimensioned drawings showing:
   a. Size and location of all concrete bases and curbs.
   b. Wall openings for equipment.
   c. Height of all pass-thru openings.
   d. Floor depressions or recesses required for any equipment, including details of pit insulation and base frame installation if required.
   e. Allied work by other contractors required for installation of equipment.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Coordinate delivery of equipment with construction progress.

B. All equipment shall be received at the building fully protected. Protect finished surfaces from soiling and damage during handling and installation. Provide protective covering.

1.06 JOB CONDITIONS

A. Contractor shall verify building conditions for access into the building and to the kitchen area. If it is necessary to have hoisting equipment, or remove any door, door frame, wall or window, this contractor shall assume the cost of doing this work.

1.07 GUARANTEE

A. Provide written guarantee against defective workmanship and materials for a period of one (1) year from the date of final acceptance by the Owner.

B. All compressors shall have an additional four (4) year warranty.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Stainless Steel:
   1. U.S. Standard gauges specified.
   2. Type 304 composition:
      18% minimum chromium, 8% nickel, and 2/10th% maximum carbon.
   3. Type 430 is not acceptable.
   4. Mill finish 180 grit one side with not less than 100 grit other side.
   5. Sheets shall bear manufacturer's trademark designating type and heat number.
   6. All sheets stretcher leveled.
   7. Hard ground finish not acceptable.

B. Galvanized Iron:
   1. Approved grade low carbon steel or copper bearing steel.
   2. Commercial quality.

C. Hardware:
   1. Heavy-duty, Chrome-Plated Brass.
      a. Walk-in door hardware shall be “Kason” or approved equal.
   2. Stainless steel where specified.
   3. All locks specified on equipment of same manufacturer, keyed alike.

D. Sound Deadening:

1. "Component Hardware", Model 075-33 NSF Approved gray latex sound deadener.

E. Sealant:
1. "Component Hardware", Model M90-101, FDA Approved clear silicone sealant.

F. Electrical:
1. Cords and plugs, neoprene type with one (1) leg grounded to framework of equipment.
   a. 120V, single phase, 20 amp, "Hubbell", Model HBL5366C or approved equal.
   b. 208V, single phase, 20 amp, "Hubbell", Model HBL5466C or approved equal.
   c. Plugs shall match receptacles provided.
2. All motors, heaters, etc., operating above 208/230V shall have integral transformers to provide 120V, single phase control circuits.
3. Receptacles in Base Cabinets:
   a. Cast aluminum type FD boxes with stainless steel faceplates.
4. Receptacles in Tops:
   a. Cast aluminum, satin finish, "Component Hardware", "T & S Brass" pedestal type, or approved equal, specified with stainless steel faceplates.
5. Two (2) or more receptacles of same voltage in same equipment, pre-wired to common junction box for one (1) final connection, providing total load does not exceed 30 amps.
   a. All pre-wiring done in rigid conduit.
   b. All wires color coded and tagged.

2.02 WALK-IN COOLERS AND FREEZERS

A. Acceptable Manufacturers:
1. Louisville Cooler Manufacturing
2. Bally Refrigerated Boxes, Inc.
3. U.S. Cooler
4. Kolpak

B. Construction.
1. A combination, two-section cooler/freezer unit per layout and configuration as shown on the drawings.
2. Pre-fabricated, insulated sections.
3. Foam tongue and groove edges.
4. Panel gasket foamed-in-place continuous one-piece construction on interior and exterior of panels.
5. All interior vertical wall corners constructed with a smooth 3/8" radius.
6. All penetrations for electric, including ceiling lights, refrigeration and drain, shall be coordinated between manufacturer, pre-drilled by walk-in manufacturer to insure clean, neat holes.
7. Vinyl wall sleeves furnished and installed by FSEC through walk-in cooler/freezer walls wherever necessary to accommodate service and drain lines. Holes for sleeves provided by FSEC. When holes and sleeves are required through building walls to accommodate drain lines, they shall be provided by General Contractor. FSEC to coordinate with General Contractor for proper location and note on Shop Drawings.
8. National Sanitation Foundation Listed.
9. Section fasteners to be cam-type insta-lok.
10. Vinyl wall sleeves furnished and installed by FSEC through walk-in cooler/freezer walls wherever necessary to accommodate service and drain lines. Holes for sleeves provided by FSEC. When holes and sleeves are required through building walls to accommodate drain lines, they shall be provided by General Contractor. FSEC to coordinate with General Contractor for proper location and note on Shop Drawings.

11. Expansion valves, pressure controls, strainers, liquid driers, sight glass with moisture indicator and all other items necessary for a first-class system furnished and installed by FSEC.

C. Insulation.
   1. All floor, wall and ceiling panels, regardless of location in freezer or cooler: 5" thick urethane, foamed-in-place.
   2. UL Listed with E-84 test of 25 or less flame spread rating.
   3. "R" factor shall be a minimum of 40.00.

D. Finishes.
   1. Exterior walls: 20 gauge, zinc bonded steel with two (2) coats of baked enamel finish
   2. Interior walls: 20 gauge, type 304 stainless steel, #3 polish finish.
   3. Interior ceiling: 24 gauge zinc bonded steel with two (2) coats of baked white acrylic finish.
   4. Interior floor: .10 diamond tread pattern aluminum.
   5. .040 minimum embossed aluminum on all non-exposed surfaces.

E. Doors and Frames:
   1. See Plan for quantity and location. All items shall be supplied per door.
   2. Clear door opening shall be 3'-0" x 7'-0" minimum.
   3. Door shall be 5" thick, foamed in place urethane insulation to match wall panels.
   4. Provide approximate 14" x 14" triple-pane, hermetically sealed peep windows. Heated in freezer.
   5. Door interior and exterior shall be same finish as adjacent walls.
   6. 1/8" aluminum diamond tread kickplates, 36" high, interior and exterior.
   7. Flush fitting poly vinyl magnetic gasket at all sides and vinyl sweep gasket on door bottom. All shall be replaceable without tools.
   8. Three (3) polished chrome, die cast zamak, cam-lift hinges.
   9. Positive pneumatic door closer, "International" Model #852AL.
   10. Horizontal, door pull with deadbolt lock with inside release. All doors keyed alike.
   11. Door and sill heater.
   12. Door frame shall include all wiring in rigid conduit concealed inside door section for lights, switches, heaters and other items at door location.
   13. Heated air pressure relief vent, 25 watts, shall be provided in ceiling panel near freezer walk-in door frame. Division 16 is responsible for final wiring to this item.
   14. Heater cables built in around entire door opening to prevent frost accumulation and sweating at cooler/freezer doors. Division 16 is responsible for final wiring to this item.
   15. Division 16 shall be responsible to provide electrical service to door sections and final connections to stub-outs on door sections and any other sections required.
   16. All doors, where building floor becomes walk-in floor, hung on chrome-plated, cam lift hinges so that bottom of door does not sweep floor when opening or closing.

F. Floor Construction:
   1. Foamed-in-place floor panels with tread pattern finish.
   2. Concrete slab by General Contractor shall be minimum of 5" deep, transit level and smooth.
   3. General Contractor shall verify all thicknesses and depths to insure that door opening is proper.

G. Lighting.
   1. Ceiling mounted, 48" long, LED fixtures with safety plastic shields. Provide pilot light and

toggle switch at door exterior.

2. Division 26 shall be responsible for installing light fixtures and wiring to door frame section.
3. Division 26 shall run all electrical conduit on external ceiling. Refrigeration box installer shall coordinate installation.
4. Division 26 shall provide required number of sealing hubs for ceiling mounted light fixture in strict accordance with detail, and shall seal completely any other electrical conduit penetrating walk-in. FSEC shall verify that sealing has occurred.
5. Division 16 must pack with insulation and seal between all other sleeves and conduit.
6. Necessary lighting to provide a minimum of twenty (20) foot candles of light at any point inside thirty (30) inches above the floor.
7. Vapor-proof light fixtures with rough service bulbs, pre-wired to flush mounted switch and pilot light, installed on exterior of each compartment adjacent to door handle. FSEC shall provide all light fixtures and sleeve(s) for conduit. Division 16 shall install light fixtures and provide final wiring to complete installation.

H. Additional Features.
1. A flush mounted, Control Products, field adjustable digital alarm designed to sound on rise or fall of temperature shall be installed on exterior wall panel next to doors on latch side. Silence switch shall only suppress the audio alarm. Digital read-out shall continue to flash until walk-in returns to performance temperature, at which time alarm shall rearm itself. Shall have cooler/freezer probe and transformer.
2. Remote alarm notification system. Connected to building computer network for purpose of sending text, email or pre-recorded telephone message when unit is operating outside the temperature parameters.

I. Vertical Trim Strips, Closure Panels.
1. Finish same as exposed exterior walls.
2. Panels shall be 5” wider than required size.
3. Provide extruded aluminum “U” channel for attachment to walk-in walls and to finish ceiling. Panels shall be removable without tools.
4. No exposed fasteners.
5. Trim strips at all locations where walk-in meets building walls. FSEC shall install 3/8” plywood to walk-in. Use mastic to secure trim strips to attached plywood.

J. Refrigeration Equipment
1. Cooler compartment design to be 36 degrees.
2. Freezer compartment design temperature to be –10 degrees.
3. Condensing units mounted in outdoor hinged condensing unit racks. Provide crankcase heater, heat pressure control, liquid line dryer, suction line vibrasorber, all factory mounts. Both units shall be thermostat-solenoid-time clock pump down cycle. Cooler with time/time defrost. Freezer with time/temperature defrost. All high side components shall be factory pre-wired through rain-tight fused disconnect switches.
4. Division 16 shall provide control wiring as indicated on wiring diagrams.
5. Refrigeration lines insulated by FSEC; lines servicing compressors less than 5 HP shall be insulated with a minimum of 3/4” thick Armaflex material. Lines servicing compressors over 5 HP shall be insulated with a minimum of 1” thick Armaflex material.
6. Timed secondary defrost termination control governing freezer automatic defrost in case of primary thermostat control failure.
7. Timed defrost controls for all cooler coils.

8. Compressors mounted on anti-noise, anti-vibration blocks and factory mounted as noted in Itemized Specifications.
9. Coils properly sized to balance compressors and installed so as to allow a maximum height possible between underside of any coil and floor.
10. Coils connected to compressors by FSEC using Type K hard drawn copper tubing, soldered with Silfos.

K. Refrigerant:
1. R-134a, CFC free.

L. Quality Assurance.
1. To insure coordination of refrigeration and to insure a clear line of responsibility for proper performance of this refrigerated unit, entire item including walk-in, trim, refrigeration and hardware must be furnished by the same manufacturer. FSEC is responsible during checkout and initial operation to insure and warranty that installer adjusts all thermostats, control valves, motors and other equipment provided by the specification with trained personnel under his direct employ.

M. Utility Connections:
1. Install per shop drawings of refrigerated box manufacturer.

2.04 BOOSTER HEATERS

A. Complete with:
1. Water pressure/temperature relief valve.
2. Two (2) temperature indicating thermometers.
3. Water pressure regulating valve.
4. Low water protection.
5. Shock absorber.
6. Adjustable thermostat set to provide required supply of 185 degree hot water at dishwasher spray nozzles or sink faucet.

B. Above items installed by Division 15 with supervision of installation by FSEC.

C. FSEC shall verify that all above items have been installed.

D. Installed in location to provide ease of access to all controls, valves, stops, etc., without moving heater and/or other equipment.

E. The booster heaters shall not discharge water any hotter than 140 degrees into the sanitary system. The equipment manufacturer of the unit being served shall be responsible to provide either internal tempering of the discharge water or a drain water tempering kit or device to accomplish the same as required to meet these requirements and the plumbing code.

2.05 DISPOSERS

A. Complete with:
1. 14 gauge stainless steel control brackets for mounting, constructed per drawing detail.
a. Brackets installed so as to allow 3” minimum clearance of control panel disconnect from front edge of roll.
2. Line strainers.
3. Body and/or legs mounted a minimum of 2” back from front edge.
4. Chrome-plated vacuum breaker as specified in Itemized Specification.

5. Chrome-plated flow control valves furnished and installed by FSEC as part of his pre connection. Fifteen (15) GPM of water shall flow into base of disposer. Ten (10) GPM of water shall flow into end of trough.
6. 14 gauge stainless steel cover plates for troughs at cone, as specified in Itemized Specifications and per detail on drawings.
7. 3" minimum waste line rough-in where feasible.
8. Stainless steel, one-piece construction transition unit (for trough mounting) to permit direct flow into disposer, unless otherwise specified in Itemized Specifications.

2.06 FAUCETS, SPRAY UNITS AND ACCESSORIES

A. All shall be:
1. Chrome-plated, heavy-duty brass.
2. Equipped with removable seats.
3. Complete with removable aerators.
4. Complete with one (1) faucet for each sink bowl or as noted in Itemized Specifications.
5. Faucet (if not otherwise indicated):
   a. Backsplash-mounted,
      "T&S Brass" Model B-230LN/60X with 8" swing spout, 1/2" inlet.
   b. Top or deck-mounted,
      "T&S Brass" Model B-220LN/60X with 8" swing spout, 1/2" inlet.
   c. Backsplash-mounted,
      "T&S Brass" Model B-0290 with 12" swing spout, 3/4" inlet.
6. Check Valves (if not otherwise indicated):
   a. Vertical – "T&S Brass" Model B-CW1-2, 1/2".
   b. Horizontal – "T&S Brass" Model B-CVH1-2, 1/2".
   c. Vertical – "T&S Brass" Model B-CW3-4, 3/4".
   d. Horizontal – "T&S Brass" Model B-CVH3-4, 3/4".
7. Pre-rinse spray assembly (if not otherwise indicated):
   a. Deck-mounted,
      "T&S Brass" Model 03-013/BR-10 consisting of Model B-0143 pre-rinse unit modified with Model B-60C hose, Model B-0970-FE backflow preventer (for continuous pressure), Model B-0109-01 wall bracket, Model BR-10 brush attachment and Model B-0512 mixing valve.
   b. Table mounted,
      "T&S Brass" Model 03-013/BR-10/B0104 consisting of Model B-0106 pre-rinse unit modified with Model B-48C hose, B-0104 hook outlet, Model B-0970-FE backflow preventer (for continuous pressure), Model BR-10 brush attachment and Model B-0512 mixing valve.
   c. Install per detail on drawings if shown.
8. Hose reel assembly (if not otherwise indicated):
   a. "T&S Brass" Model B-1403 with 35'-0" hose, Model B-2339-LR stainless steel control box (when specified), Model ORK4 vacuum breaker, Model B-0512 mixing valve (when specified), Model ORK2 shut-off valve.
   b. Install per detail on drawings if shown.
9. All items shall be manufactured by one of the following:
   a. "T & S Brass".
   b. "Chicago Faucet".
   c. "Fisher".

B. Vacuum Breakers:
1. Mounted neatly above table top or backsplash, as required.
2. "Fisher", 1/2" Model 3990 and 3991.

2.07 SINK DRAINS

A. Minimum 2” I.P.S. or as specified.

B. Complete with rear-connected overflow for each sink bowl.

C. 4” long chrome-plated tailpiece.

D. Interconnect with chrome-plated continuous waste assembly of same size as drain, where two (2) or more are mounted immediately adjacent to each other.

E. All shall be twist handle, quick opening type unless otherwise specified.
1. “Component Hardware”, Model DSS-8000 stainless steel rotary drain with stainless steel twist handle assembly and Model E50-1000 overflow assembly. Furnish overflow assembly in accordance with sink size and type.

F. Where specified furnish Component Hardware, Model D34-Y011 stainless steel box pattern waste with stainless steel basket, cover (for floor sumps).

2.08 QUICK DISCONNECT ASSEMBLIES

A. Each of the following water hose kits shall consist of stainless steel braided hose with extruded coating, quick disconnect fitting, one (1) retractable cable, one (1) surelink restraining cable and all necessary hardware.
1. “T&S Brass” Model HW-4C-*SK, 1/2” hot water inlet.
2. “T&S Brass” Model HW-4D-*SK, 3/4” hot water inlet.
3. “T&S Brass” Model HW-4E*SK, 1” hot water inlet.
4. “T&S Brass” Model HC-4C-*SK, 1/2” cold water inlet.
5. “T&S Brass” Model HC-4D-*SK, 3/4” cold water inlet
6. “T&S Brass” Model HC-4E*SK, 1” cold water inlet.
7. “T&S Brass” Model HC-4F-*SK, 1-1/4” cold water inlet.
8. “T&S Brass” Model HC-4G-*SK, 1-1/2” cold water inlet.

B. FSEC to field verify hose length required for each application to insure hose does not rest on floor and equipment can be moved for cleaning.

2.09 FABRICATION AND MANUFACTURE

A. Leg Assemblies:
1. Legs 1-5/8" O.D., stainless steel.
2. Cross rails 1-1/4", stainless steel.
3. Cross rails welded to legs ground and polish to a smooth fillet.
4. Feet to be stainless steel, adjustable, bullet shape with 1-1/2" adjustment minimum.
5. Feet to have vermin-proof closed bottoms and unexposed threads.
6. Legs attach to tops with stainless steel gussets welded to table top.
7. Legs to be removable, held by set screws to gussets.
8. Legs spacing not more than 4'-0" O.C., connected with cross braces unless otherwise noted.

B. Table Tops:
1. 14 ga. stainless steel.
2. All seams and corners welded.
3. Heights to be 35" to 34", or as noted.
4. All reinforced with 4" x 2" inverted 14 ga. galvanized channels with 1" flanges welded to top.

5. Studs to have chrome plated acorn nuts.
6. Cross members at each pair of legs, length and width.
7. Three channels welded lengthwise on the underside of tops up to 30" wide. Channels spaced maximum of 24" O.C. on tops over 30" in width.
8. Undercoated with approved sound-deaden.
9. Unless against wall or otherwise noted, to turn down 2" at 90° and back 1/4" at 45°.
10. Where they are against walls and/or other equipment provide 8" high backsplash with 2" return at 45° and down 1/2". All horizontal and vertical corners to be 3/4" cove. End of splashes welded closed.

C. Dishtables:
1. 14 ga. stainless steel tops.
2. Backsplash 8" high with 2" return at 45° and down 1/2".
3. Edges not adjacent walls and/or other equipment to have 2" high 1-1/2" 180° rolled rim, corners bullnosed.
4. Tops slope to dishwasher, sink, trough, cone and/or quick drain.
5. At dishwashers turn down per manufacturers recommendation, bolt and seal.
6. Pass-thru shall be integral with top and backsplash.
7. Quick drains to be 4" wide by 3" deep integral with top with removable perforated splash cover, and 1" chrome plated brass drain.

D. Drawers:
1. Bodies 18 ga. stainless steel with 1" radius horizontal and 2" radius vertical corners.
2. Face 16 ga. stainless steel weld to body.
3. Drawer slides to be sloped, mounted on angle frame with nylon roller bearings.
4. Pan slide assemblies to be removable.
5. Size 20" x 20" x 5", unless indicated otherwise.

E. Sinks:
1. 14 ga. stainless steel welded in place.
2. Corners to have 3/4" cove welded, smoothed and polished on interior and exterior.
3. Adjacent sink partitions to be double metal thickness welded in place and coved.
4. To have lever handled waste with rear connected overflow.
5. Faucets to be as specified and with removable seats.
6. All sink sections shall be mounted on legs, complete with cross braces at front and ends.

F. Drainboards:
1. 14 ga. stainless steel weld integral to sinks.
2. Rims and backsplash to match sinks coved 3/4".
3. Slope to sink.
4. Two (2) legs, with cross braces between legs, are required for support when drainboard length does not exceed 54". A minimum of four (4) legs are required for drainboards, over 54".

G. Undershelves:
1. 16 ga. stainless steel. Removable type.
2. Supported by connecting rails.

H. Overshelves:
1. 12" wide or less 16 ga. stainless steel.
2. Wider than 12" 14 ga. stainless steel.
3. Ends and front turn down 1-1/2" at 90° and under 1/4" at 45°.
4. When adjacent to wall or fixtures turn up 1-1/2" with a minimum of 1/2" cove.

5. All corners welded , ground and polished.
6. Supporting brackets to be 14 ga. stainless steel cantilever type.
7. When specified as table mounted support with 1-5/8" stainless steel tubing going through backsplash and braced below table top.

I. Disposer Troughs:
1. 14 ga. stainless steel.
2. 6” deep minimum at high side, sloped to match depth of sink at disposer.
3. Slope to disposer and sink approximately 1/4" per foot or as otherwise shown.
4. Provide water inlet, plumbed to disposer solenoid by the Mechanical Contractor.
5. Provide removable stainless steel cover and water dam in trough.
6. Disposer to mount so legs are a minimum of 4" from front of table.

J. Stainless Steel Backsplash:
1. 24 ga. stainless steel.
2. Material custom cut and made to proper size and configuration.
3. To include all cutouts and custom openings and fittings to adjacent surfaces.

K. Under Table Doors:
1. Doors on all under table shelf or cabinet areas to be enclosed by doors.
2. Horizontal bypass sliding type, non-hinged and non-swinging.
3. Stainless steel to match counters and tables.

L. Grinding, Polishing and Finishing:
1. All joints, including field joints, unless otherwise specified, shall be welded and suitable ground flush with adjoining material and neatly finished to harmonize with same. Wherever materials have been depressed or sunken by the welding operation, such depressions shall be hammered and peened flush with the adjoining surfaces, and again ground to eliminate low spots. All ground surfaces shall be polished or buffed to match adjoining surfaces, consistent with good workmanship. Care shall be exercised in all grinding operations to avoid excessive heating of the metal and metal discoloration.

2. The texture of the final polishing operations shall be uniform and smooth. The general finish of all metal shall be of a high grade. Wherever sheared edges occur, they shall be free of burrs and projections to eliminate all danger of cutting and laceration when the hand is drawn over sheared edges. Where miters of bullnose corners occur, they shall be neatly finished with the under edge of the material neatly ground to a uniform condition and in no case shall over-lapping of material be acceptable. It is the intention of the specifications to cover equipment of a high quality finish consistent with the highest grade of manufacturing practice in the industry.

2.10 SINK WARNING SIGN

A. Sink bowls containing 180-190 degree hot water shall be provided with an 8” x 10” red plastic warning sign with white inscribed lettering secured to wall above sink compartment. Sign shall read as follows: “WARNING: THIS SINK BOWL CONTAINS VERY HOT 180 (190) DEGREE WATER – USE EXTREME CARE”.

2.11 FILTERS

A. Provide on all equipment items with a direct water connection, whether specified elsewhere or not. Specifically, all ice machines, steamers and combi-ovens shall be provided with filters.

B. Filters do not need be provided on the dishmachine, sinks or lavatories.

C. Equipment manufacturer shall be responsible to provide a proper filter as required with the capacity and capabilities to service the equipment load and demand as required.

D. Locate directly adjacent to the equipment item served, installed on the water service entry side of the unit, and fully accessible for replacement and service.

2.12 WASTE WATER COOLING SYSTEM

A. Food service equipment shall not discharge water any hotter than 140 degrees into the sanitary system.

B. Provide on all equipment items that utilize a water connection of 140 degrees or above, whether specified elsewhere or not. Specifically, all dishmachines, booster heaters, kettles and combi-ovens shall be provided with a waste water cooling system.

C. The equipment manufacturer of the unit being served shall be responsible to provide either internal tempering of the discharge water or a drain water tempering kit or device to accomplish the same as required to meet these requirements and the plumbing code.

PART 3 - EXECUTION

3.01 INSPECTION

A. Before any floor is poured, verify all roughing-in, wall openings, floor depressions, and notify the Architect of any errors, and/or omissions.

3.02 FIELD QUALITY CONTROL

A. The equipment supplier shall provide a representative on the premises during the installation of all food service equipment and shall supervise the installation of the equipment connections.

3.03 ADJUST AND CLEAN

A. All equipment resting against walls, floors, and/or ceilings shall be sealed to same with mastic sealer.

B. Before final inspection, remove all protective covering from all equipment and give all items of equipment a thorough cleaning and servicing, leaving all equipment free of defects, clean and ready for operation.

3.04 SCHEDULE OF EQUIPMENT

ITEM #1A Milk Cooler
MFGR: “Beverage-Air” - Owner’s Existing Units

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #1B Serving Counter, 6-Well, Mobile, Combination
MFGR: “Delfield”
MODEL: FlexiWell – ShelleyGlas Mobile hot, cold & freeze combination serving, KFW-6-NU

Provide and install where shown, electric, 6-well unit, 9’-4” long x 30” wide x 34” high, standard construction and fiberglass finish complete with all standard accessories furnished with this model and as follows:

A. Features:
1. Top: Exterior top is constructed of 14-gauge stainless steel, welded, ground and polished into one integral unit. Top is fabricated with square exterior corners.

2. Interior: Interior liner is constructed of aluminum with flush mount flange for heating or cooling to accommodate up to 6" (15cm) deep 12"x20" pans, supplied by others. Dry operation only, no water required.
3. Exterior body: Seamless, one-piece molded fiberglass.
4. Refrigeration: R290.
5. Operation: Remove control panel contains 3-way hot/cold/off power switch and thermostat for heated, cold and freeze operation.
6. Wells operate independently for hot/cold/freeze operations in any combination.
7. Counter height: 34".
8. Casters: 5" diameter swivel casters.

B. Accessories.
1. Tray slides.
2. Work shelves.
3. Single service glass front sneeze-guard.
4. Line-up interlock device.

ITEM #1C Serving Counter, Frost Top, Mobile
MFGR: "Delfield"
MODEL: Mobile Self-Contained Frost Top Serving Counter, KDFT-74-NUP – 74"

Provide and install where shown, electric, frost top unit, 74" long x 30" wide x 34" high, standard construction and fiberglass finish complete with all standard accessories furnished with this model and as follows:

A. Features:
1. Frost top is stainless steel, one-piece construction and perimeter trough. Underside of frost top is sealed with refrigeration lines and insulated with high-density, closed cell environmentally friendly, Kyoto Protocol Compliant, Non ODP (Ozone Depletion Potential), Non GWP (Global Warming Potential) polyurethane. Frost top assembly is enclosed in a galvanized steel jacket. The frost top is separated from the exterior top be a thermal break.
2. Exterior body: Seamless, one-piece molded fiberglass.
3. Exterior Top: Constructed of stainless steel, welded, ground and polished into one integral unit. Top is fabricated with square exterior corners.
4. Refrigeration: R290.
5. Counter height: 34".
6. Casters: 5" diameter swivel casters.

B. Accessories.
1. Tray slides.
2. Work shelves.
3. Single service glass front sneeze-guard.
4. Open understorage with shelf
5. Line-up interlock device.

ITEM #2 Tray Rack, Mobile
MFGR: "InterMetro" or approved equal
MODEL: MetroMax Q, Polymer / Wire Shelving

Provide and install where shown with all standard features and specified options:

A. Size and Accessories:
1. 18" deep x 36" wide x 74" high.

2. Shelves:
3. All units shall consist of four (4) shelves.
4. Stem casters on all units.
5. Maximum weight capacity: 900 pounds.

B. Utility Connections:
1. See Food Service Equipment Schedule on drawings.

ITEM #3 Refrigerator, 2-Section, Pass-Thru
MFGR: True or Approved Equal
MODEL: STG2RPT-2G-2S-HC

Provide and install where shown, two-section, self-contained units. Provide all service connections. Units complete with all standard features and specified options:

A. Exterior: Stainless steel door, with matching aluminum sides.

B. Interior: Aluminum side walls and back. Stainless steel floor and ceiling.

C. Doors: Glass door, Low-E, double pane thermal insulated glass. Solid door: Stainless steel.

D. Size: 52-5/8” wide x 36-1/8” depth x 77-3/4” high

E. Refrigerant.
1. R290

F. Accessories.
1. Nine (9) sets of universal type tray slides and pilaster, bottom supports, per unit.
2. 5” diameter plate castors. Locks provided on front set.

G. Utility Connections:
1. See Food Service Equipment Schedule on drawings.

ITEM #4 Hot Food Holding, 2-Section, Pass-Thru
MFGR: True or Approved Equal
MODEL: STG2HPT-2G-2S

Provide and install where shown, two-section, self-contained units. Provide all service connections. Units complete with all standard features and specified options:

A. Exterior: Stainless steel door, with matching aluminum sides.

B. Interior: Aluminum side walls and back. Stainless steel floor and ceiling.

C. Doors: Glass door, Low-E, double pane thermal insulated glass. Solid door: Stainless steel.

D. Size: 52-5/8” wide x 36-1/8” depth x 77-3/4” high.

E. Accessories.
1. Nine (9) sets of universal type tray slides and pilaster, bottom supports, per unit.
2. 5” diameter plate castors. Locks provided on front set.

F. Utility Connections:
1. See Food Service Equipment Schedule on drawings.

ITEM #5 Microwave
MFGR: "Amana" RCS10TS, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #6 Wall Cabinet, Enclosed
MFGR: "Eagle Group"
MODEL: Wall Cabinets, WCH-54

Provide and install with all standard features and specified options:
A. Construction:
1. 14 gauge type 304 stainless steel, fully welded construction.
2. Sloped top.
3. Stationary center shelf with safety edges.
4. Hinged doors.
5. Unit size: 54" wide x 15" deep x 24" high at front, 28" high at back.

B. Utility Connections:
1. No service required.

ITEM #7 Hot Water Dispenser
MFGR: "Hatco" AWD-12, Owner's Existing Units

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #8 Prep Table, 54"
MFGR: "Eagle Group" or approved equal.
MODEL: "Spec-Master" series, T3048SE-BS

Provide and install with all standard features and specified options:
A. Construction:
1. 14 gauge type 304 stainless steel, fully welded construction.
2. 1-1/2" roll on front edge; sides turned down 90 degrees.
3. 4-1/2" backsplash.
4. Size: 48" wide x 30" deep x 35-1/8" high.
5. 1-1/4" o.d. stainless steel tubular cross bracing on sides and rear.

B. Options / Accessories:
1. Center drawer.
2. Stainless steel bullet feet.
3. Stabilizer Bar.

ITEM #9 Refrigerator, 1-Section, Reach-In
MFGR: True or approved equal
MODEL: T-23-HC

Provide and install where shown, single-section, self-contained unit. Unit complete with all standard features and specified options. Provide all service connections.

A. Refrigerant.
   1. R290.

B. Size: 27” wide x 29-1/2” deep x 78-3/8” high

C. Accessories:
   1. 6” high casters.
   2. Three (3) adjustable, heavy duty PVC coated wire shelves with clips.
   3. Provide (3) additional shelves.

D. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

ITEM #10 Prep Table, 120” (Worktable with Sink and Enclosed Storage)
MFGR: Fabricated.

Provide and install where shown, 10’-0” long x 2’-0” wide x 3’-0” high at work surface.

A. Top:
   1. 14 gauge stainless steel, one-piece, all welded construction
   2. Front and end edges, per detail.
   3. Backsplash, per Detail.
   4. One (1) sink, 18”x18”x8” deep, with deck faucet with rear connected overflow, per General Specification.
   5. Underbracing, per details.

B. Base Section:
   1. 1-5/8” o.d. stainless steel tubing legs and crossbraces below sink.
   2. Enclosed base cabinets underneath with bi-pass sliding doors.
   3. One (1) tier of three (3) drawers in stainless steel enclosed base.
   4. 6” high stainless steel counter type legs, Component Hardware, model A77-5048.

C. Performance.
   1. FSEC shall show complete Details on Shop Drawings for approval.

D. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

ITEM #11 Wall Cabinet, Enclosed
MFGR: “Eagle Group”
MODEL: Wall Cabinets, WCH-42

Provide and install with all standard features and specified options:

A. Construction:
   1. 14 gauge type 304 stainless steel, fully welded construction.
   2. Sloped top.
   3. Stationary center shelf with safety edges.
   4. Hinged doors.
   5. Unit size: 42” wide x 15” deep x 24” high at front, 28” high at back.

B. Utility Connections:
   1. No service required.

ITEM #12 Prep Table, 84"
MFGR: "Eagle Group" or approved equal.
MODEL: "Spec-Master" series, T3084SE-BS

Provide and install with all standard features and specified options:

A. Construction:
   1. 14 gauge type 304 stainless steel, fully welded construction.
   2. 1-1/2" roll on front edge; sides turned down 90 degrees.
   3. 4-1/2" backsplash.
   4. Size: 84" wide x 30" deep x 35-1/8" high.
   5. 1-1/4" o.d. stainless steel tubular cross bracing on sides and rear.

B. Options / Accessories:
   1. Center drawer.
   2. Stainless steel bullet feet.
   3. Stabilizer Bar.
   4. Additional undershelf.

ITEM #13 Refrigerator, 1-Section, Roll-In
MFGR: "True" or approved equal
MODEL: Spec Series; Roll-in Solid Swing Door Refrigerator; STG1RRI-1S

Provide and install where shown, single-section, self-contained unit. Unit complete with all standard features and specified options. Provide all service connections.

A. Refrigerant.
   1. R290.

B. Size and Features: 35" wide x 34-3/4" deep x 83-3/4" high.
   1. One (1) heavy gauge stainless steel ramp.
   2. Designed to accept roll-in racks with maximum dimensions of 27"L x 29" x 66"H.
   3. 6" high casters.

C. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

D. Additional Required Item:
   1. "Channel Mfg" UR-11 Aluminum Mobile Universal Rack – 11 pan.
      a. Dimensions: 25-1/2"wide x 26" depth x 64" high.

ITEM #14 Utility Cart
MFGR: Owner's Existing Units

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #15 3-Compartment Sink
MFGR: Owner's Existing Unit, Fabricated

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

A. Accessories:
   1. Replace two (2) existing backsplash mounted faucets.

B. Utility Connections:
   1. Reconnect existing garbage disposal and control panel with vacuum breaker.
   2. Reconnect existing pre-rinse assembly at pre-rinse sink.

ITEM #16 Combi Oven with Equipment Stand
MFGR: "Hobart", SCC WE 102, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #16A Combi Oven
MFGR: "Hobart"
MODEL: iCombi Classic

Provide and install with all standard features and specified options:
A. Features and Accessories.
   1. 10-full size pan capacity.
   2. Provide Stand II Mobility Line.
   3. Water treatment program.
   4. Waste water cooling system.
   5. Spray and hose assembly.

B. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

ITEM #17 Tilting Skillet
MFGR: Owner's Existing Unit
MODEL: "Legion" CS41-11, Owner's Existing Units

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #18 Tilting Skillet
MFGR: "Rational"
MODEL: iVario Pro 2-S

Provide and install with all standard features and specified options:
A. Features and Accessories.
   1. 6-cooking modes and 5-cooking processes.
   2. Low temperature cooking.
   3. Digital display with pre-built programs.
   4. Two pans can be used independently from each other.
   5. Automated lifting and lowering mechanism for cooking in baskets.
   6. Stand with electric height adjustable feet. No separate electrical connection required.

B. Utility Connections:
1. See Food Service Equipment Schedule on drawings.

ITEM #19 Rotating Rack Oven
MFGR: "Blodgett" XR8E, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #20 Drying Rack, Mobile
MFGR: "InterMetro" or Approved Equal
MODEL: Super Erecta Pro, Mobile

Provide and install where shown, mobile shelving:
A. Size and Accessories:
1. 48" wide x 21" deep x 75-1/2" high.
2. Shelves: Open-grid with anti-microbial protection.
3. All units shall consist of four (4) shelves.
4. Stem casters on all units.

ITEM #21 Backing Rack, Mobile
MFGR: "Channel Mfg"
MODEL: Universal Racks, UR-12

Provide and install with all standard features and specified options:
A. Description:
1. All-welded Aluminum Mobile Universal Rack – 12 pan.
B. Accessories:
1. Pan stop, aluminum.
2. Perimeter bumper.

ITEM #22 Wall Cabinet, Enclosed
MFGR: "Eagle Group"
MODEL: Wall Cabinets, WCH-48

Provide and install with all standard features and specified options:
A. Construction:
1. 14 gauge type 304 stainless steel, fully welded construction.
2. Sloped top.
3. Stationary center shelf with safety edges.
4. Hinged doors.
5. Unit size: 48" wide x 15" deep x 24" high at front, 28" high at back.

B. Utility Connections:
1. No service required.

ITEM #23 Prep Table, 102"
MFGR: "Eagle Group" or approved equal.
MODEL: "Spec-Master" series, T3096STE-BS

Provide and install with all standard features and specified options:
A. Construction:

1. 14 gauge type 304 stainless steel, fully welded construction.
2. 1-1/2" roll on front edge; sides turned down 90 degrees.
3. 4-1/2" backsplash.
4. Size: 96" wide x 30" deep x 35-1/8" high.
5. 1-1/4" o.d. stainless steel tubular cross bracing on sides and rear.

B. Options / Accessories:
1. 3-drawer stack.
2. Stainless steel bullet feet.
3. Stabilizer Bar.

ITEM #24 Ingredient Bin
MFGR: "Rubbermaid Commercial Products"
MODEL: 3600-88

Provide and install with all standard features and specified options as follows:

A. Construction:
1. Industrial grade molded plastic bin with structural web construction.
2. Slant front clear plastic sliding lid with integral clasp.
3. 2.75 cu. ft. storage capacity.
4. Provide 32 oz. scoop.
5. Set of four (4) 3" high casters.

B. Utility Connections:
1. No service required.

ITEM #25 Hot Food Holding, 1-Section, Roll-In
MFGR: "True" or approved equal
MODEL: Spec Series; Roll-in Solid Swing Door Heated Cabinet; STG1HRI-1S

Provide and install where shown, single-section, self-contained unit. Unit complete with all standard features and specified options. Provide all service connections.

A. Refrigerant.
1. R290.

B. Size and Features: 35" wide x 34-3/4" deep x 83-3/4" high.
1. One (1) heavy gauge stainless steel ramp.
2. Designed to accept roll-in racks with maximum dimensions of 27"L x 29" x 66"H.
3. 6" high casters.

C. Utility Connections:
1. See Food Service Equipment Schedule on drawings.

D. Additional Required Item:
1. "Channel Mfg" UR-11 Aluminum Mobile Universal Rack – 11 pan.
a. Dimensions: 25-1/2"wide x 26" depth x 64" high.

ITEM #26 Mixer
MFGR: "Hobart" D-3001, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #27 Mixer
MFGR: "Hobart" H-600T, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #28 Prep Table, Double-Sided, 84"
MFGR: Fabricated.

Provide and install where shown, 7'-0" long x 5'-0" wide x 3'-0" high at work surface.

A. Top:
   1. 14 gauge stainless steel, one-piece, all welded construction
   2. Front and end edges, per detail.
   3. Underbracing, per details.

B. Base Section:
   1. Enclosed base cabinets underneath with bi-pass sliding doors.
   2. One (1) tier of three (3) drawers in stainless steel enclosed base.

C. Performance.
   1. FSEC shall show complete Details on Shop Drawings for approval.

D. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

ITEM #29 Heat Sealer
MFGR: "Preferred Packaging" HS-48, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #30 Wall Bumper Rail
MFGR: Fabricated

Provide and install where shown on drawings, continuous wall-mounted bumper, constructed per details.

A. Construction:
   1. 14 gauge stainless steel, one-piece all welded construction.
   2. Top slope on 45 degrees.

B. Performance:
   1. FSEC to show complete details on shop drawings for approval.

ITEM #31 Can Rack with Can Opener
MFGR: "Garde"
MODEL: Half size Aluminum Can Rack with Can Opener, CANSTN72

Provide and install with all standard features and specified options:

A. Description:
1. Aluminum can rack for #10 cans.
2. Stainless steel top.
3. Heavy Duty Can Opener attached to top.
4. Holds (72) #10 or (95) #5 cans.
5. Fully welded.
6. Four 5 inch swivel plate casters.

ITEM #32 Prep Table, 96”
MFGR: Fabricated

Provide and install where shown, 8’-0” long x 2’-6” wide x 3’-0” high at work surface.

A. Top:
1. 14 gauge stainless steel, one-piece, all welded construction
2. Front and end edges, per detail.
3. Backsplash, per Detail.
4. One (1) sink, 18”x18”x8” deep, with deck faucet with rear connected overflow, per General Specification.
5. Underbracing, per details.

B. Base Section:
1. 1-5/8” o.d. stainless steel tubing legs and crossbraces.
2. One (1) center drawer with undershelf below.

C. Performance.
2. FSEC shall show complete Details on Shop Drawings for approval.

D. Utility Connections:
1. See Food Service Equipment Schedule on drawings.

ITEM #33 Potato Peeler with Disposer
MFGR: Hobart or Approved Equal
MODEL: 6460

Provide and install where shown, floor model peeler, complete with electric disposer (Item#43A) all standard accessories furnished with this model.

A. Electrical.
1. 1 HP, 120V, 1 phase, 2.5 amps.

B. Accessories.
1. Disposer stand
2. Cabinet base and peel trap with stainless steel strainer
3. In-Sink-Erator disposer, Model SS-50
4. Provide all required controls for disposer operation with peeler

ITEM #34 Milk Cooler
MFGR: Owner’s Existing Units

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #35 Dishtable, Soiled End
MFGR: Fabricated

Provide and install where shown, 10'-0" long x 2'-0" wide x 3'-0" high at work surface.

A. Top:
   1. 14 gauge stainless steel, one-piece, all welded construction
   2. Front and end edges, per detail.
   3. Backsplash, per Detail.
   4. Pass-thru sill and splash integral with top, front edge per details.
   5. Lip top down 1" into Item #36 with backsplash and front roll constructed to be watertight.
   6. Underbracing, per details.

B. Scrap Trough.
   1. Trough shall be 6" wide x length as shown on drawings.
   2. Entire trough/sump combination shall be integral with top, and give one-piece appearance. Designed to transfer waste to disposer without accumulation or restriction, per details.
   3. End of trough fitted with water inlet, Component Hardware, model K36-6000.
   4. One (1) only 14 gauge stainless steel, removable flat sump cover, edge turned down 1/4".

C. Pre-Rinse Sink.
   1. Sink bowl shall have welded throat adapter to accommodate Item #43.
   2. One (1) faucet with 8" swing spout located on backsplash in accordance with General Specifications.
   3. 14 gauge stainless steel removable rack guide, flush with table top.

D. Soak Sink.
   1. Sink bowl shall have welded throat adapter to accommodate Item #43.
   2. One (1) spray assembly located on backsplash in accordance with General Specifications.
      a. One (1) spray assembly, T & S Brass, model B0143, modified with B-60C hose, B-970-FE, and B-109-1 wall bracket, B-0512 mixing valve.
      b. One (1) only spray hose assembly, T & S Brass, model B-0106, and B-0512 mixing valve, with stainless steel bracket, per details.

E. Base Section:
   1. 1-5/8" o.d. stainless steel tubing legs and crossbraces below sink.
   2. Undershelf below as shown on drawings.
   3. 6" high stainless steel counter type legs, Component Hardware, model A77-5048.

F. Performance.
   1. FSEC shall show complete Details on Shop Drawings for approval.
   2. FSEC shall coordinate pass-thru opening size and roll-up door with architectural details and all trades involved in this Section of work.

G. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

ITEM #36 Dishmachine
MFGR: "Insinger" Admiral, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #36A Stainless Steel Exhaust Vent Ducts
MFGR: Fabricated

Provide and install where shown, per General Specifications, Section 11 40 00, complete with all standard accessories furnished with this model, and as follows:

A. Construction.
1. FSEC shall provide two (2) only 18 gauge stainless steel vent ducts, per details, from connection points on machine to 6" above ceiling, with stainless steel trim collars at ceiling. FSEC shall transition to single aluminum duct, extend and connect to exhaust fan.

ITEM #36B Booster Heater
MFGR: "Hatco", C-17, Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #37 Dishtable, Clean End
MFGR: Fabricated

Provide and install where shown, dishtable in dimensions shown on drawings. Unit shall be constructed in accordance with General Specifications, Section 11 40 00, details, and as follows:

A. Top.
1. 14 gauge stainless steel, one-piece, all welded construction.
2. Front and end edges, per detail.
3. Backsplash, per detail.
4. Underbracing, per detail.

D. Base Section:
1. 1-5/8" o.d. stainless steel tubing legs and crossbraces.
2. Undershelf below worksurface.
3. 6" high stainless steel counter type legs, Component Hardware, model A77-5048.

C. Performance.
1. FFEC shall show complete Details on Shop Drawings for approval.

ITEM #38 Ice Machine
MFGR: Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #39 Ice Machine
MFGR: Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #40 Cashier Stand
MFGR: Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #41 Salad Bar Unit
MFGR: Owner's Existing Unit

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location. Provide all service connections.

ITEM #42 Pre-Rinse Assembly
MFGR: "T&S Brass and Bronze Works, Inc."
MODEL: B-0133-B

Provide and install with all standard features and specified options as follows:

A. Construction:
   1. Easy-install type, wall-mount mixing faucet with flex hose and overhead spray head.
   2. 8" center-to-center spacing with color-coded lever handles.
   3. 18" riser with model #004R finger hook.
   4. Pre-assembled spring body, overhead spring, 44" flex hose and spray valve.
   5. Model #B-0107 spray valve and bracket.
   6. Model #B-0109-01 6" wall bracket.

B. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

ITEM #43 Garbage Disposal & Control Panel
MFGR: "In-Sink-Erator"
MODEL: SS Series, Food Waste Disposers, SS-200 / AS-101

Provide and install where shown, unit of standard construction and finish, complete with all standard accessories furnished with this model, in accordance with General Specifications and as follows:

A. Accessories.
   1. Model AS-101, Aqua Saver control panel.
   2. Fisher, model 3990, ½" vacuum breaker in lieu of standard unit.
   3. Flow control valve, 10 gpm
   4. One year extended service/labor warranty.

B. Utility Connections:
   1. Electrical: 2 HP.

C. Performance:
   1. Control panel shall be recessed under top so controls do not interfere with normal operation.

ITEM #43A Garbage Disposal & Control Panel
MFGR: "In-Sink-Erator"
MODEL: SS Series, Food Waste Disposers, SS-100 / AS-101

Provide and install where shown, unit of standard construction and finish, complete with all standard accessories furnished with this model, in accordance with General Specifications and as follows:

A. Accessories.
   1. Model AS-101, Aqua Saver control panel.
   2. Fisher, model 3990, ½" vacuum breaker in lieu of standard unit.
   3. Flow control valve, 10 gpm
   4. One year extended service/labor warranty.

B. Utility Connections:
   1. Electrical: 1 HP.
   2. Connect to Potato Peeler (Item #33).

C. Performance:
   1. Control panel shall be recessed under top so controls do not interfere with normal operation.

ITEM #44 Floor Sump
MFGR: Fabricated

Provide and install where shown, unit, 30" long x 22" wide to accommodate Item #44 (tilting skillet). Unit shall be constructed in accordance with detail.

A. Construction
   1. 14 gauge stainless steel, all welded, one-piece construction.
   2. Stainless steel removable top grate (anti-slip surface).
   3. Box pattern waste, per General Specifications.

ITEM #45 Dunnage Rack
MFGR: "Metro" or approved equal
MODEL: Polymer Bow-Tie Dunnage Racks, HP22xxPDMB

Provide and install where shown with all standard features and specified options:

A. Construction:
   1. 22" deep x width shown on Drawings x 12" high.
   3. Microban protection.
   4. Racks join together without tools, with polymer tie feature on sides and ends.
   5. Maximum weight capacity: 1,500 pounds per 30" and 36" unit; 3,000 pounds per 48" unit.

ITEM #46 Exhaust Hood System
MFGR: econ□air (AKA Captive-Aire) or Approved Equal
MODEL: Custom. See Kitchen Drawings.

Provide and install with all standard features and options as specified herein and shown on Drawings:

A. General:
   1. Provide and install complete cook line exhaust system per drawings.
   2. Complete system to include: exhaust fan, supply fan with gas fired furnace, hood, fire protection system, connecting duct, start up/air balance/service.
   3. System to meet all requirements of NFPA Code 96, UL and bear the NSF seal #908.

B. Exhaust Fan:
   1. Side inlet, vertical discharge exhaust fan located inside building on suspended mechanical equipment platform above kitchen ceiling.
   2. Listed for use with kitchen exhaust vapors.

3. Fan to include disconnect switch and grease catch cup.

C. Supply Fan:
1. Cabinet to be constructed of 18 gauge galvanized steel.
2. Blower inside case to be heavy gauge, rigid steel die stamped housing.
3. Preslok wheel to have sealed sleeve bearings. Drive sheave and motor base plate to be adjustable.
4. Motor to be open drip proof with ball bearings. Motor plate and bearings to be mounted on vibration isolators.
5. Factory wired three phase disconnect switch in unit cabinet to be included.
Factory to install motor starters for exhaust and supply fans inside supply fan cabinet.
6. Outside air intake shroud to include four (4) washable aluminum outside air filters.
Motorized backdraft damper to be mounted in unit make up air outlet.
Damper to close when unit is turned off to prevent outside air infiltrating into building.
7. Exterior of fan cabinet to be painted.

D. Direct Fired Gas Furnace:
1. Furnace to be natural gas fuel.
2. Burner box to be all galvanized steel material. Baffle plates to be installed in burner box to provide proper air flow across burner for ordered CFM.
3. Control box to be all galvalume steel material. Cabinet door to be lift out type for reach access to controls.
4. Burner to have cast iron supports and stainless steel perforated air foils.
5. 30 to 1 turndown ratio for optimum energy efficiency.
6. Spark ignition to be on all control systems. Controls include 50 to 90 degrees operating range.
7. All components are factory mounted in the furnace.
8. Control voltage to be 115/60/1.
9. Standard manifold to be set for 7” gas pressure. Burner control to be Maxitrol electronic control system. Controls pilot on-off so that standing pilot is not required.
10. Wiring harness is included to provide control voltage from supply fan to furnace.

E. Roof Curbs and Equipment Support Rail:
1. Fabricated for a flat roof, 16” high minimum.
2. Curb style to be consistent with other curbs furnished for this project.
3. Curb material to be 18 gauge, all welded galvanized construction.
4. Internally insulated with rigid fiberglass with foil backing.
5. Equipment support rail to be same construction and material as curb with adjustable cap for leveling in the field.

F. Hood:
1. Hood to be fabricated in sections. Factory to furnish all fasteners required for assembly in the field.
2. Hood body to be constructed of 18 gauge, type 304 stainless steel. UL Listed construction without exhaust dampers. Double thickness outside end panels solid welded and polished to face with no exposed joints.
3. Grease filter frames to be stainless steel. Filter rack mullion to be tack welded to inside end panel. Integral bottom grease filter frame forms a pitched drip guard draining to a stainless steel drip pan. Furnish stainless steel Fire Fighter grease filters with stainless steel blank-off panels, as required.
4. Hood lights: recessed LED fixtures.
5. Wireway Cover – vertical stainless steel wireway cover centered on length of hood front.

6. Control Switches – Oil tight switches to control hood lights, fans on –off and heat on-off mounted on wireway cover. Provide nameplate indicating switch function. Factory to wire fixtures and switches to individual junction box on top of the hood.
7. Provide field wrapper between top of hood and ceiling on all exposed sides, constructed of same material as hood body.

G. Fire Protection System:
1. Furnish and install Ansul UL 300 Listed, liquid agent type. System to provide hood, duct, plenum and required surface protection.
2. Exposed piping to be chrome sleeved or stainless steel.
3. Mount system on end of hood in enclosed cabinet as shown on drawings.
4. Furnish dual micro switch with system and mechanical gas valve (to be installed by Mechanical Contractor).

H. Installation:
1. Include hanging hoods, setting fans and furnace, locate roof curbs and equipment support rail on shop drawings to be provided, fabricating and installing connecting ducts, fabricating and installing make up air plenum.
2. Exhaust duct to be 20 gauge 430 stainless steel. All seams to have continuous liquid-tight external welds. Furnish clean-outs, as required.
3. Make up air duct to be 22 gauge steel, and fabricated per SMACNA low pressure standards. Make up air plenum to be installed full length of hood front at the ceiling line.
4. Plenum to be constructed of steel, painted an off-white finish, with perforated steel face and interior diffuser.

I. Exhaust System Work by Other Trades:
1. General Contractor:
a. Provide roof deck openings. Set in place and flash (with cant if required) roof curbs and equipment support rail furnished by the hood system manufacturer.
b. Frame roof curb openings are required. Coordinate joist or structural member installation to provide required clearances for ductwork and shaft assemblies.

2. Electrical Contractor:
a. Provide 120/60/1, 20 amp circuit, for hood lights and control to junction box on top of hood.
b. Provide 3 phase circuit (for fan motors) to disconnect switch mounted on exterior of supply fan cabinet.
c. Extend power wiring from motor starter panel (mounted on exterior of supply fan) to connection point on exhaust fans.
d. Provide conduit and four wires from terminal block on hood to terminal block on supply fan motor starter panel.
e. Provide 120 volt control circuit through the heat switch to the furnace.
f. Provide conduit and two wires from terminal block on hood to micro-switch of fire protection system. Interlock wiring of the supply fans motor control device through the fire system micro switch, shutting off supply air in the event of fire system actuation.
g. Furnish and install on octagon box for the fire system pull station, mounting the centerline of the box at 42”-48” above the furnished floor.
h. Run ½” conduit from the top of the box to 6” above the ceiling. Pull station to be furnished with fire system.
i. Furnish and install automatic power shut off devices (shunt trip breakers, or definite purpose contactors) with interlock to fire system micro switch, shutting off all power

below the hood (including control voltage) in the event of fire system actuation. This work must be in accordance with NFPA 17A, IMC Chapter 20, and the NEC.

3. Mechanical Contractor:
   a. Provide net room air demand as indicated on the hood system drawings. This air volume is required only when hood system is in operation.
   b. Provide normal heating and cooling of the kitchen area.
   c. Heating and install service to gas fired furnace on building roof.

J. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.
   2. Install per requirements of details on kitchen drawings.

ITEM #46A Emergency Ansul Pull Station

Refer to Drawings K-401 and K-402.

ITEM #47 Hose Reel Assembly

MFGR: T & S Brass or Approved Equal
MODEL: B-7232-01

Provide and install where shown, one (1) only open type reel, wall-mounted above top of drainboard, complete with all standard accessories furnished with this model, per details.

A. Accessories.
   1. One (1) only mixing valve, model B-0512.
   2. One (1) only vacuum breaker, Fisher, model 3990.

B. Installation.
   1. Mount hose reel in secure manner where shown on details.
   2. Install tempered water lines from mixing valve to hose reel.
   3. Install all appropriate accessories listed in water lines.

ITEM #48 Fly Fan

MFGR: Fantech or Approved Equal
MODEL: AC4800

Furnish and install unheated air curtain above door as shown on drawings.

A. Performance.
   1. 2400 FPM air velocity
   2. Sound level, 45-54 dba.

B. Utility Connections:
   1. See Food Service Equipment Schedule on drawings.

ITEM #49 Prep Table, 96”

MFGR: Fabricated

Provide and install where shown, 8’-0” long x 2’-6” wide x 3’-0” high at work surface.

D. Top:
   6. 14 gauge stainless steel, one-piece, all welded construction
   7. Front and end edges, per detail.
   8. Backsplash, per Detail.
   9. One (1) sink, 18”x18”x8” deep, with deck faucet with rear connected overflow, per General Specification.

10. Underbracing, per details.

E. Base Section:
3. 1-5/8" o.d. stainless steel tubing legs and crossbraces.
4. One (1) center drawer with undershelf below.

F. Performance.
3. FSEC shall show complete Details on Shop Drawings for approval.

D. Utility Connections:
1. See Food Service Equipment Schedule on drawings.

ITEM #50 Walk-in Shelving Unit
MFGR: Owner's existing equipment.

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location.

ITEM #51 Dry Storage Shelving
MFGR: Owner's existing equipment.

Remove from existing kitchen, protect and store until new kitchen construction complete, install at new location.

ITEM #52 Dry Storage Shelving
MFGR: "Metro" or Approved Equal
MODEL: Metro Super Adjustable Super Erecta, 5-shelf Industrial Wire Shelving Starer Unit

Provide and install where shown, mobile shelving:
A. Size and Quantity.
1. 21" deep x 74" high x width shown on Drawings (varies).
2. Open-grid wire shelving.
3. All units shall consist of four (5) total shelves including top and bottom shelves.
4. Provide all units as a "starter", standalone unit.
5. Chrome finish.

ITEM #53 Wall Shelf
MFGR: "Eagle Group" or Approved Equal
MODEL: Wall Shelves, WS1248-14/3

Provide and install where shown, mobile shelving:
A. Size and Quantity.
1. 12" deep x 48" wide.
2. 1-1/2" roll on front.
3. 1-1/2" upturn on rear and ends.
4. Die-formed stainless steel mounting brackets are stud-welded to shelf.
5. All stainless steel polished to #4 finish.

ITEM #54 Walk-in Cooler & Freezer
Provide and install where shown, a combination, two-section cooler/freezer unit in accordance with Plans, General Specifications and Section 11 45 00.

PART 3 - EXECUTION

3.01 ADJUST AND CLEAN

A. Before any floor is poured, verify all roughing-in, wall openings, floor depressions, and notify the Architect of any errors, and/or omissions.

A. Before final inspection, remove all protective covering from all equipment and give all items of equipment a thorough cleaning and servicing, leaving all equipment free of defects, clean and ready for operation.

SUBMITTAL CHECKLIST

1. Equipment Brochures.
2. Shop Drawings.
3. Rough-In Drawings.

END OF SECTION 11 40 00

SECTION 12 24 00 - WINDOW SHADES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this section includes furnishing of and paying for all materials, labor, equipment, mounting hardware and other items required for execution and completion of roll-up fabric window shades.

B. Work covered by this Section includes:
   1. Dual-Roller Window Shades, with a screen fabric shade and a light blocking fabric shade.

1.02 SUBMITTALS

A. Window Shades Schedule:
   1. Indicate locations including room numbers, quantities and field measurements of dimensions for all window blinds.
   2. Indicate proposed mounting and fastening procedurals.

B. Product Data:
   1. Manufacturer's product data sheets, cutsheets, specifications, materials description, installation and maintenance instructions.

C. Samples:
   1. Actual samples of all items needed for colors and finishes.
   2. Colors and finishes to be selected by Architect from manufacturer's entire selection.

1.03 DELIVERY

A. Deliver materials in manufacturer's original, unopened, containers, labeled so as to allow easy identification.

1.04 WARRANTY

A. Mounting hardware, headbox, fascia, chain and clutch operator – Twenty-five (25) years.
B. Shade Fabric – Ten (10) years.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:
   1. "Hunter Douglas Contract"
   2. "Draper"
   3. "Mecho Shade"

2.02 DUAL-ROLLER WINDOW SHADES

A. Provide one of the following approved products
   1. “Hunter Douglas Contract", FR Roller Shade.
   2. "Draper", Flexshade.
   3. “MechoSystems”, Mecho/5 Manual Shades.

B. Description:
   1. Manually operated, dual vertical roll-up, fabric window shades with bead chain and clutch

operating mechanism.
2. One roller with screen fabric shade.
3. One roller with light blocking fabric shade.

C. Mounting Style:
1. Inside of window opening and extending from head to sill and jamb to joint.

D. Operation:
1. Bead chain and clutch operating mechanism allowing shade to stop when chain is released.
2. Designed never to need adjustment or lubrication.
3. Provide preset limit stops to prevent shade from being raised or lowered too far.
4. Clutch mechanism to be fabricated from high carbon steel and molded fiberglass reinforced polyester or injected molded nylon.
5. Control loop to be stainless steel bead chain hanging at side of window.

E. Fascia:
1. L-shaped aluminum extrusion to conceal shade roller and hardware.
2. Finish: Baked enamel.
3. As indicated on the Drawings, or if not indicated, to be selected by Architect from manufacturer's entire selection.

F. Color:
1. As indicated on the Drawings, or if not indicated, to be selected by Architect from manufacturer's entire selection.

2.03 SCREEN FABRIC

A. Basis of Specification: "Sheerweave" SW2400 (2410).

B. Description:
1. Interior sun control, PVC coated fiberglass woven full basketweave.

C. Attributes:
1. Weight: 14.1 ounces per square yard
2. Thickness: .020 inches
3. Roll Width: 63 inches, 98 inches, or 126 inches
4. Openness: 3 percent
5. Class A Fire Rating
6. Bacteria and fungal resistant.

D. Color:
1. V22 Charcoal/Gray

2.05 LIGHT BLOCKING FABRIC

A. Basis of Specification: "SunBloc" SB9100.

B. Description:
1. Close woven fiberglass base textile with sun-resistant PCE film securely bonded to each side.

C. Attributes:
1. Weight: 12 ounces per square yard
2. Thickness: .013 inches

3. Roll Width: 72 inches maximum width without seam
4. Opacity: 100%
5. Fire Resistant
6. Fade and Mildew Resistant

D. Color: Black SB9170 (with white backing)

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Contractor shall be responsible for inspection of site, approval of mounting surfaces, installation conditions and field measurements for this work.

B. Field measure all openings and conditions.

3.02 INSTALLATION

A. Install shades level and plumb, allow clearance for proper operation, and demonstrate blinds to be in uniform and smooth working order.

A. Provide clearance between sash and shades to permit unencumbered operation of sash hardware.

B. Install the fascia, closure panels and end caps with to conceal roller and operating mechanisms. Exposed fasteners are unacceptable.

D. Isolate metal parts from concrete and mortar to prevent galvanic action.

E. Protect installed units to ensure their being in operating condition, without damage, blemish, or indication of use at Substantial Completion of project. Correct non-conforming damaged unit. Replace units that cannot be field corrected.

3.03 CLEANING

A. Clean finished installation of dirt and finger marks. Leave work area clean and free of debris.

SUBMITTAL CHECK LIST

1. Window Shades Schedule.
2. Product Data.
3. Samples.

END OF SECTION 12 24 00

SECTION 12 32 16 – PLASTIC LAMINATE CABINETS AND CASEWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install all pre-finished, pre-fabricated, plastic-faced, cabinets and casework as shown on the Drawings and specified herein, including delivery to the site, storing, unpacking, setting in place, leveling, anchoring to walls and floors, and all other required activities need for a complete installation.
B. Plastic laminate casework is indicated on the Equipment Drawings.
C. Color/finish selections for plastic laminate casework/countertops are indicated on the Interior Drawings.
D. Equipment items for plastic laminate casework are indicated on the Equipment Drawings.
E. Solid Surface countertops as indicated on the Drawings atop plastic laminate casework.

1.02 QUALIFICATIONS

A. Supplier's Qualifications:
   1. Manufacturers of Plastic Laminate Cabinets and Casework should be pre-qualified prior to bidding.
   2. Shop of manufacturer should be certified by the Architectural Woodwork Standards (AWS), and be capable of providing proof of such certification upon request.
   3. Manufacturers wishing to be included on the pre-qualified list herein shall submit qualifications in writing to the Architect no later than ten (10) days prior to the bid.

B. Pre-qualified Manufacturers of Plastic Laminate Cabinets and Casework:
   1. Adams Cabinetry and Installations.
   2. Advanced Cabinet Systems, Inc.
   3. Case Systems, Inc.
   4. Classic Cabinets & Millwork.
   5. Corman and Associates, Inc.
   6. Euronique, Inc.
   7. Four Stone Mill and Casework.
   8. LSI.
   9. Meyer Custom Woodworking.
   10. P.R. Bean Company.
   11. Smith Laminating, Inc.
   12. Southern Cabinetry, Inc.
   13. Stevens.
   14. Stidham Cabinet, Inc.
   15. Thermo Scientific Hamilton.
   16. TMI.
   17. Wood Tek, Inc.

1.03 QUALITY ASSURANCE

A. Comply with the latest edition of the Architectural Woodwork Standards (AWS) “Quality Standards”. References to Premium, Custom, or Economy in this specification are to be as defined in this publication.

B. Provide items and work with a minimum of Custom Grade, with true balanced construction.

C. Provide items and installation of straight, flat, level, plumb, and true quality and craftsmanship. Items provided that create an installation not acceptable for these reasons, or otherwise deemed unacceptable for purposes of aesthetics or maintenance, shall be removed and replaced by the Contractor without additional costs to the Owner. Final determination shall be made by the Architect.

D. Any inconsistencies or irregularities in the surface or product will be cause for rejection. All rejected products shall be removed and replaced with new at no additional cost to the Owner. The evaluation of acceptance and rejection is at the sole discretion of the Architect.

1.04 SUBMITTALS

A. Samples:
   1. Complete range of manufacturer's standard finishes where colors are not specified.
   2. Samples of specified items only, where colors have been indicated.
   3. Samples of each type, material, and color of countertop specified.

B. Shop Drawings:
   1. Field measurements shall be taken to verify that cabinets and casework will fit into designed space. Entryways, corridors, and door openings shall be verified to ensure that the equipment be manufactured in a manner to permit it to be moved through properly into place.
   2. Show layout of cabinets with product reference numbers, details of construction, dimensions, elevations, rough-ins, materials, finishes, hardware, and accessories.
   3. Reference Architect’s nomenclature of product identification as indicated on the Drawings.

1.05 DELIVERY, STORAGE AND HANDLING

A. Protect casework during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.

B. Do not deliver casework until painting, wet work, grinding, and similar operations which could damage, soil, or deteriorate casework have been completed in installation areas.

C. Deliver casework as needed for immediate installation whenever possible. Casework delivered ahead of time for installation shall be stored by Contractor until project areas are ready for installation.

1.06 WARRANTY

A. Casework contractor shall guarantee to replace or repair, at no expense to the Owner, all materials of this contract found to be defective within one year of acceptance (Substantial Completion), due to defective materials and/or workmanship.

1.07 DEFINITIONS

A. Clarification:
   1. For purposes of this specification, definitions of surfaces shall be as indicated below.
   2. Some restrictions herein may be more restrictive or differ from the AWS Quality Standards. Where differences occur, the most restrictive specification shall take precedence.

B. Exposed Surfaces:
   1. Any cabinet or component surface that is visible when doors and drawers are closed.
   2. All open cabinet surfaces, shelving and components.
   3. Cabinet surfaces, shelving and components visible through glass doors.
   4. Bottom surfaces of all cabinets that are not concealed atop permanent construction or casework.
   5. Top surfaces of all cabinets that are not concealed below permanent construction or casework.
   6. Side surfaces of all cabinets that are not concealed against permanent construction or casework.
   7. All surfaces of all cabinets that are not concealed after fixed appliances are installed.
   8. Front edges of cabinets and body members that are visible.
   9. Front edges of cabinets and body members that are seen through a gap of 1/8” or greater with doors and drawers closed.
   10. Ends and toe kicks when visible after installation.
   11. Ends, back and sides of freestanding cabinets that are not permanently installed, attached to other

casework, or are intended to be relocatable. These surfaces may be hidden from view in one application, but in full view in another when relocated.

C. Semi-Exposed Surfaces:
1. Any cabinet or component surface that is visible when doors and drawers are in the open position.
2. Any interior cabinet or component surface behind either solid doors, drawer fronts, sliding solid doors or expanded metal screen doors.
3. Back surfaces of solid doors and drawers.

D. Concealed Surfaces:
1. Surfaces not visible after installation of casework.
2. Surfaces not visible when doors and drawers are open.
3. Tops of cabinets that are to receive a counter top.
4. Surfaces which are concealed from view and non-accessible in corners and voids created by intersection of multiple cabinets.
5. Surfaces behind finished closure and filer panels.
6. Stretchers, blocking and components concealed from view by drawers.
7. Toe kicks when rubber base or like material is scheduled for installation directly to surfaces.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hardwood Plywood: Product Standard PS 51.

B. Softwood Plywood: Product Standard PS 1.

C. Plastic Laminate:
1. Acceptable Manufacturers:
a. "Wilsonart"
2. Comply with NEMA LD-3 for type, thickness, color, pattern, and finish as indicated for each application.
3. Provide high pressure laminate in grades indicated for the following types of surfaces:
a. Horizontal Surfaces High-pressure decorative laminate VGS-50 (0.050”).
b. Vertical Surfaces: High-pressure decorative laminate VGS-28 (0.028”).
c. Exposed Cabinet Body Exterior: High-pressure decorative laminate VGS-28 (0.028”).
d. Door and Drawer Fronts: High-pressure decorative laminate VGS-28 (0.028”).
e. Exposed Cabinet Body Interior (Without a Door): High-pressure decorative laminate VGS-28 (0.028”).
f. Semi-Exposed Cabinet Body Interior (Through a Glass Door): Thermally-fused melamine laminate with CL-20 cabinet liner at surface required to achieve true balanced construction, manufacturer's standard “white” in color.
g. Interior Concealed Surfaces: Thermally-fused melamine laminate, manufacturer's standard “white” in color.
4. Balanced construction of both faces of surfaces is required.
5. Laminate grain patterns are to run vertically and be vertically matched within each unit.

D. Solid Surface Material:
1. Acceptable Manufacturers and Products:
a. "Dupont", "Corian".
b. "Wilsonart", "Gibraltar".
c. "Formica", "Evermore Solid Surfacing".

2. 1/2” thick for countertops, installed over particleboard backer, for total thickness of 1" minimum.
3. 1/2” thick for edge banding, built-up to provide a face depth of 1”, unless indicated otherwise.
4. 1/2” thick for backsplashes and end splashes, 4" high unless otherwise noted.

E. Particleboard:
1. Industrial grade engineered board core material.
2. 47 pound density, non-telegraphing.
3. 3/4” thick, medium density particleboard, Type 1-M-2.
4. 1/2” thick minimum, medium density particleboard, Type 1-M-2, under solid surfacing countertops.

F. Accessories:
1. Filler, tops, end and side closures; finish to match adjacent cabinets and countertops.
2. Finished back and end panels as required or indicated.
3. Back splashes. End splashes only as specified.

G. Shelving:
1. Fully adjustable, typically.
2. Fixed where required for unit stability and/or positive door latching.
3. 1” thick 36” wide or greater, 3/4” thick less than 36” wide.
4. Shelves over 47” in length to have additional center support.

H. Edge Trim:
1. Material:
   a. 1mm (.020” actual) rigid PVC banding, stain finish, machine applied.
   b. 3mm rigid PVC banding, stain finish, machine applied with 3mm radius edge profile.
2. 3mm PVC banding at edges of doors and drawers.
3. 3mm PVC banding at edges of countertops, including splashes, typical.
4. 1mm PVC banding at edges of shelves, front and back.
5. 1mm PVC banding at all other case and leading edges.

I. Colors:
1. Colors as selected from manufacturer’s entire selection, no limit on number of colors selected.
2. If colors are indicated on the Drawings, colors and patterns must be matched.
3. For purposes of color selections, countertops shall include all splashes, aprons, supports and cleats where no base units are provided, unless noted otherwise.
4. For purposes of color selections, all fillers and panels shall match adjacent exposed cabinet faces.

2.02 HARDWARE

A. Hinges:
1. Five knuckle, 270 degree, Institutional Grade 1 hinge.
2. Constructed of .090” minimum thickness steel.
3. Hospital tipped with non-removable pin.
4. 2-1/2” chrome, satin finish.
5. Mounted to door and case with not less than three screws per wing.
6. Concealed or with off-set wrap around wings, as selected by the Architect.
7. Lifetime guarantee as warranted by the hardware manufacturer.

B. Drawer Slides:
1. Standard full extension telescoping drawer slide; 3/4 extension slides are not acceptable.
2. Self-closing epoxy coated steel drawer slide with smooth, quiet operation and lateral stability.
3. 100 lb. static load rating, minimum. 150 lb. static load rating, minimum at all file drawers.
4. Lifetime guarantee as warranted by the hardware manufacturer.

C. Drawer Stops:
   1. Shall be provided on all drawers to prevent inadvertent removal.
   2. Shall be automatic type, zinc plated steel.

D. Pulls For Drawers and Doors:
   1. 4” solid metal bent wire pull.
   2. Shall be of clean, modern design offering a comfortable hand grip and shall attach through drawer or door with machine screws on each end of pull.
   3. Extruded aluminum with satin lacquer finish.
   4. Install centered on all drawer fronts.

E. Adjustable Shelf Supports:
   1. Injection molded clear polycarbonate shelf support.
   2. Shall friction fit into cabinet end panels and vertical dividers and be adjustable on a 32mm center precision drilled line bore pattern.
   3. Shall have 2 integral 5mm diameter support pins to interface pre-drilled holes, and to prevent accidental rotation of support.
   4. Shall automatically adapt to 3/4 inch or 1 inch thick shelving and provide a non-tip feature for shelving.
   5. 250 lb. minimum static load rating per support without failure.
   6. Shelves longer than 47” shall have additional support standard and brace at center span.

F. Door and Drawer Locks:
   1. Locks shall be furnished on all doors and drawers shown and noted on Casework Elevations.
   2. Locks shall be standard disc tumbler with removable core (cam style), master keyed and furnished with two keys per lock.
   3. Locks used for double door applications shall be capable of securing both doors simultaneously without the need for additional elbow or deadbolt catches or bolt on the passive door.
   4. Furnished with two keys per lock. Master key as required.
   5. Unless otherwise specified, key casework per the following requirements:
      a. Science labs shall have all doors and drawers keyed individually within room with a master key for entire room.
      b. All other spaces shall have all doors and drawers keyed alike within entire room.
      c. Provide grandmaster key to operate all locks of all master keys for all spaces.

G. Door Catches:
   1. Heavy duty magnetic type catch.
   2. Shall have matching white plastic coated housing and dual floating magnet poles.
   3. Holding strength of 5kg.
   4. Doors less than 48” in height shall have 1 magnetic catch mounted at either the top or bottom of each door.
   5. Doors over 48 inches in height shall have 1 magnetic catch mounted at both the top and bottom of each door.
   6. Doors shall receive a matching steel strike plate attached with threaded fasteners.

H. Tall Case Latching Assembly:
   1. Provide at all tall case double swinging doors.
   2. Shall consist of an eccentric plate operating two 1/8” x 5/8” plated vertically operating locking bars.
   3. Each bar shall operate through an extruded nylon guide and, when locked, shall engage a strike plate providing positive latching for the left hand door.
   4. The lock attached to the right hand door shall operate a bolt which, when locked, shall overlap the

left hand door providing secure locking.
5. Single doors shall be locked to case sides.

I. Silencers:
1. Cork, plastic, or rubber type silencers.
2. Provide on all drawers and doors.

J. Chain Stops:
1. Shall be provided at the top of all doors to all tall cabinets.
2. Provide chain stops at the top of all doors to all base and wall cabinets that open directly into a wall surface or obstruction.
3. Finish of chains and stops to match hinges.

K. Countertop Brackets
1. “A&M Hardware” Work Station Brackets 24” x 24” Bracket. Finish: White.
2. “A&M Hardware” Work Station Brackets 24” x 29” Bracket. Finish: White.

2.03 FABRICATION

A. Base:
1. Continuous under all base and storage cabinets.
2. Rubber base furnished and installed per Section 09 65 00.

B. Countertops:
1. 1/2” thick solid surface installed over particleboard backer for total of thickness of 1” minimum.
2. Thicknesses as specified for all other countertop materials.
3. Continuous 4” x 3/4" back and end splashes, unless otherwise noted, to match countertop material.
4. Aprons, size and locations as shown on drawings.
If not indicated on drawings, provide 4" apron along all exposed edges of all countertops in locations where without base cabinets.

C. Drawers:
1. Shall be constructed so as to provide full solid sides and components for the entire box.
2. Sides composed of no solid panel or of simply the guide or sliding hardware is not acceptable.

D. Joinery:
1. Handwrap fluted dowel construction.
2. 8mm minimum.
3. Doweled and glued.

PART 3 - EXECUTION

3.01 INSPECTION

A. Assure adequate anchorage, grounds, blocking, nailers, and supports.

B. Assure that plumbing and electrical rough-ins are complete.

3.02 INSTALLATION

A. Install casework plumb with top level.

B. Anchor cabinets to floors and walls.

C. Install fillers, trim, sinks and accessories required for complete installation.

D. Touch up all marred surfaces to match original.

E. Replace any items or surfaces damaged during shipping, delivery, storing, installation, or construction activities.

F. Coordinate sinks and other items that are to be installed in casework so as to insure that they will fit into casework as intended. Obtain templates for items prior to fabrication of bases or countertops. Coordinate needed changes to cabinets to allow for items specified without additional costs to the Owner.

SUBMITTAL CHECK LIST

1. Samples.
2. Shop Drawings.

END OF SECTION 12 32 16

SECTION 20 01 00 - GENERAL PROVISIONS - MECHANICAL

PART 1 – GENERAL:

1.1 The Advertisement for Bid, Instructions to Bidders, Bidding Requirements, General, Special and Supplementary Conditions, and all other Contract Documents shall apply to the Contractor's work as well as to each of their Sub-Contractor's work.

1.2 All manufacturers, suppliers, fabricators, contractors, etc. submitting proposals for any part of the work, services, materials, or equipment to be used on or applied to this project are hereby directed to familiarize themselves with the Contract Documents. In case of conflict between these General Provisions and the General and/or Special Conditions, the Contractor shall contact the Engineer for clarification and final determination prior to the Bid.

1.3 The work included in this Division consists of the furnishing of all labor, equipment, transportation, excavation, backfill, supplies, material, appurtenances, and services necessary for the satisfactory installation of the complete and operating Mechanical Systems indicated or specified in the Contract Documents.

1.4 Any materials, labor, equipment, or services not mentioned specifically herein which may be necessary to complete any part of the Mechanical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the Plans and/or Specifications, shall be included in the Bid as part of this Contract.

1.5 It is not the intent of this Section of the Specifications to make any Contractor, other than the Prime Contractor responsible to the Owner. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be routed through the General Contractor to the Architect, then to the Engineer. Also, this Section of the Specifications shall not be construed as an attempt to arbitrarily assign responsibility of work, material, equipment or services to a particular trade or Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be optional.

1.6 The Architect and Engineer do not define the scope of individual trades, subcontractors, material suppliers and vendors. Any sheet numbering system or specification numbering system used which identifies disciplines is solely for the Architect and Engineer’s convenience and is not intended to define a subcontractor’s scope of work. Information regarding individual trades, subcontractors, material suppliers and vendors may be detailed, described, and indicated at different locations throughout the Contract Documents. No consideration will be given to requests for change orders for failure to obtain and review the complete set of Contract Documents when preparing Bids, prices, and quotations. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

1.7 It is the intent of the Contract Documents to deliver to the Owner a new, complete, and operational project once the work is complete. Although Plans and Specifications are complete to the extent possible, it shall be the responsibility of the Contractors involved to remove and/or relocate or re-attach any existing or new systems which interfere with new equipment or materials required for the complete installation without additional cost to the Owner.

1.8 In general, all work shall be accomplished without interruption of existing facilities operations. The Contractor shall advise the Owner at least seven (7) days prior to the interruption of any services (gas, domestic water, heating, etc.). The Owner shall be advised of the exact time that interruption will occur and the length of time the interruption will last. Failure to comply with this

requirement may result in complete work stoppage for the Contractors involved until a complete schedule of interruptions can be developed.

1.9 Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore said service. The Contractor shall provide tools, materials, skilled journeymen of Bidder/Proposer's own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation from the Owner.

1.10 Each Bidder/Proposer shall also be governed by any unit prices and Addenda insofar as they may affect part of their work or services.

1.11 DEFINITIONS AND ABBREVIATIONS:

- Contractor - Any Contractor whether bidding, proposing, or working independently or under the supervision of a General Contractor, Prime Contractor, Construction Manager and who installs any type of Mechanical Work as specified in the Contract Documents or, the General Contractor.
- Engineer - The Consulting Mechanical-Electrical Engineer either consulting to the Owner, Architect, or Other, etc. In this case: CMTA, Inc., Consulting Engineers.
- Architect - The Architect of Record for the project.
- Contract Documents - All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Contract with Owner, etc.
- Bidder/Proposer - Any person, agency or entity submitting a proposal to any person, agency, or entity for any part of the work required under this contract.
- The Project - All of the work required under this Contract.
- Furnish - Deliver to the site in good condition and turn over to the Contractor who is to install.
- Provide - Furnish and install complete, tested, and ready for operation.
- Install - Receive and place in satisfactory operation.
- Indicated - Listed in the Specifications, shown on the Plans or Addenda thereto.
- Typical or Typ.- Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
- ADA - Americans with Disabilities Act.
- AGA - American Gas Association.
- ANSI - American National Standards Institute.
- ASHRAE - American Society of Heating, Refrigeration and Air Conditioning Engineers.
- ASME - American Society of Mechanical Engineers.
- IBC - International Building Code.
- NEC - National Electrical Code.
- NEMA - National Electrical Manufacturers Association.
- NFPA - National Fire Protection Association.
- OSHA - Office of Safety and Health Administration.
- SMACNA - Sheet Metal and Air Conditioning Contractors National Association.
- UL - Underwriters Laboratories.

PART 2 – INTENT AND INTERPRETATION:

2.1 It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc as necessary for trouble free operation,

tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included as part of the Bid.

2.2 All Contractors and Vendors providing a bid for this project shall review the Plans and Specifications and determine any modifications and/or adjustments necessary relative to the proposed equipment and materials with specific manufacturer's installation requirements. Include in the bid any necessary installation methods, features, options, accessories, etc. necessary to install the proposed equipment and materials, regardless of whether used as basis of design or being offered as a substitution in accordance with the specific manufacturer's installation requirements whether specifically detailed or not within the Plans and Specifications.

2.3 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

2.4 The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer / Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.

2.5 The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten (10) days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

PART 3 – INDEMNIFICATION:

3.1 The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

PART 4 – PLANS AND SPECIFICATIONS:

4.1 The Plans are diagrammatic only and indicate the general arrangement of the systems and are to be followed. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the Engineer for approval before proceeding with the work. The Plans are not intended to show every item which may be necessary to complete the systems. All Bidder/Proposers shall anticipate that additional items may be required and submit their Bid accordingly.

4.2 The Plans and Specifications are intended to supplement each other. No Bidder/Proposer shall take advantage of conflict between them, or between parts of either. Should this condition exist, the Bidder/Proposer shall request a clarification not less than ten (10) days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be final.

4.3 The Plans and Specifications shall be considered to be cooperative and anything appearing in the Specifications which may not be indicated on the Plans or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.

4.4 Contractor shall make all of their own measurements in the field and shall be responsible for correct fitting. The work shall be coordinated with all other branches of work in such a manner as to cause a minimum of conflict or delay.

4.5 The Engineer shall reserve the right to make adjustments in location of piping, ductwork, equipment, etc. where such adjustments are in the interest of improving the project.

4.6 Should conflict, overlap or duplication of work between the various trades become evident, this shall be called to the attention of the Engineer. In such event neither trade shall assume to be relieved of the work which is specified under their branch until instructions in writing are received from the Engineer.

4.7 Unless dimensioned, the Plans only indicate approximate locations of equipment, piping, ductwork, etc. Dimensions given in figures on the Plans shall take precedence over scaled dimensions and all dimensions, whether given in figures or scaled, shall be verified in the field to ensure no conflict with other work.

4.8 Each Bidder/Proposer shall review all Plans in the Contract Documents to ensure that the work they intend to provide does not create a conflict with or affect the work of others in any way. Where such effect does occur, it shall be the Bidder/Proposer's responsibility to satisfactorily eliminate any such conflict or effect prior to the submission of their proposal. Each Bidder/Proposer shall in particular ensure that there is adequate space to install their equipment and materials. Failure to do so shall result in the correction of such encroachment conflict or effect of any work awarded the Bidder/Proposer and shall be accomplished fully without expense to others and that they are reasonably accessible for maintenance. Check closely all mechanical and electrical closets, chases, ceiling voids, wall voids, crawl spaces, etc., to ensure adequate spaces.

4.9 Where on the Plans a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornamentation or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

4.10 Details not usually shown or specified, but necessary for the proper installation and operation of systems, equipment, materials, etc., shall be included in the work, the same as if herein specified or indicated.

4.11 Where within the Contract Documents the word “typical” or “typ.” is used, it shall mean that the work method or means indicated as typical shall be repeated in and each time it occurs whether indicated or not.

4.12 Each Contractor shall evaluate ceiling heights specified on Architectural Plans. Where the location of equipment or systems may interfere with ceiling heights or maintenance and access of equipment or systems, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Do not install equipment or systems in the affected area until the conflict is resolved. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work or cost incurred on the part of the Contractor or unduly delay the work.

4.13 Ductwork is to be closely coordinated with all systems and ceiling clearances. There will be no change-orders paid for duct fit issues.

PART 5 – EXAMINATION OF SITE AND CONDITIONS:

5.1 Each Bidder/Proposer shall inform themselves of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, above and below grade, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work.

5.2 Each Bidder/Proposer shall also fully acquaint themselves with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of utilities, etc. A proposal shall cover all expenses or disbursements in connection with such matters and conditions. No allowance will be made for lack of knowledge concerning such conditions after Bids are accepted.

PART 6 – EQUIPMENT AND MATERIALS SUBSTITUTIONS OR DEVIATIONS:

6.1 When any Contractor requests approval of materials and/or equipment of different physical size, weight, capacity, function, color, access, than the design allows for it shall be understood that such substitution, if approved, will be made without additional cost to anyone other than the Contractor requesting the change regardless of changes in connections, space requirements, electrical characteristics, etc. from that indicated, electrical service, etc. In all cases where substitutions affect other trades, the Contractor requesting such substitutions shall advise all such Contractors of the change and shall compensate them for all necessary changes in their work. Any Plans, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not in any way absolve the Contractor of this responsibility.

6.2 Notwithstanding any reference in the Specifications to any article, device, product, material, fixture, form, or type of construction by name, make or catalog number, such reference shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition; any devices, products, materials, fixtures, forms, or types of construction which, in the judgment of the Engineer, are equivalent to those specified are acceptable, provided the provisions of this Part are met. Requested substitutions shall be submitted to the Engineer a minimum of ten (10) days prior to Bid. If this procedure is not followed, the substitution will be rejected. If prevailing laws of cities, towns, states, or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

6.3 Wherever any equipment and material are specified exclusively only such items shall be used unless substitution is accepted in writing by the Engineer.

6.4 Each Bidder/Proposer shall furnish along with their proposal a list of specified equipment and materials which is to be provided. Where several makes are mentioned in the Specifications and the Contractor fails to state which, they propose to furnish, the Engineer shall choose any of the makes mentioned without change in price. Inclusion in this list shall not ensure that the Engineer will approve shop drawings unless the equipment, materials, etc., submitted in shop drawings are satisfactorily comparable to the items specified and/or indicated.

PART 7 – CODES, RULES, PERMITS, FEES, INSPECTIONS, REGULATIONS, ETC.:

7.1 The Contractor shall give all necessary notices, obtain, and pay for all permits, government sales taxes, fees, inspections, and other costs, including all utility connections, meters, meter settings, taps, tap fees, extensions, etc. in connection with their work. They shall also file all necessary

plans, prepare all documents, and obtain all necessary approvals of all governmental departments and/or the appropriate municipality or utility company having jurisdiction, whether indicated or specified or not. They shall also obtain all required certificates of inspection for their work and deliver same to the Engineer before request for acceptance and final payment for the work.

7.2 Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

7.3 The Contractor shall include in their work, without extra cost, any labor, materials, services, apparatus, and Plans in order to comply with all applicable laws, ordinances, rules, and regulations, whether or not indicated or specified.

7.4 All materials furnished and all work installed shall comply with the National Fire Codes of the National Fire Protection Association, with the requirements of local utility companies, or municipalities and with the requirements of all governmental agencies having jurisdiction.

7.5 All materials and equipment so indicated and all equipment and materials for the electrical portion of the mechanical systems shall bear the approval label of or shall be listed by the Underwriters' Laboratories (UL), Incorporated. Each packaged assembly shall be approved as a package. Approval of components of a package shall not be acceptable.

7.6 All plumbing work is to be constructed and installed in accordance with applicable codes, Plans and Specifications which have been approved in their entirety and/or reflect any changes requested by the Authority Having Jurisdiction. Plumbing work shall not commence until such Plans are in the possession of the Plumbing Contractor.

7.7 All Heating, Ventilation and Air Conditioning work shall be accomplished in accordance with the Building Code and amendments thereto, the latest standards recognized by the American Society of Heating, Refrigerating and Air Conditioning and the National Fire Protection Association.

7.8 The Contractor shall furnish three (3) copies of all Final Inspection Certificates obtained to the Engineer when work is complete. Final payment for work will be contingent upon compliance with this requirement.

7.9 Where minimum code requirements are exceeded in the Design, the Design shall govern.

7.10 The Contractor shall ensure that their work is accomplished in accord with the OSHA Standards and that they conduct their work and the work of their personnel in accord with same.

7.11 All work relating to the handicapped shall be in accord with regulations currently enforced by the Authority Having Jurisdiction and the American Disabilities Act.

7.12 All pressure vessel installations shall comply with the State, and/or Federal Code applicable. A Certificate of Final Boiler Inspection shall be required.

7.13 Work in elevators, elevator shafts and elevator equipment rooms shall comply with the Elevator Code enforced by the Authority Having Jurisdiction.

7.14 All work in conjunction with a natural gas installation shall, in addition to all other Codes, Rules, Regulations, Standards, etc., comply with the requirements of the local gas supplier and/or standards and recommendations of the American Gas Association.

7.15 All work in relation to domestic water systems shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the requirements of the local water utility company.

7.16 All work in relation to the installation of sanitary or storm sewers shall, in addition to all other Codes, Rules, Regulations and Standards, be in compliance with the local agency governing such installations.

7.17 Discharge of any toxic, odorous, or otherwise noxious materials into the atmosphere or any system shall be subject to regulations of the Environmental Protection Agency (EPA) and/or the air pollution control commission. If in doubt, contact the State Department for Environmental Protection.

7.18 Where conflict arises between any code and the Plans and/or Specifications, the code shall apply except in the instance where the Plans and Specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten (10) days prior to bid date, otherwise the Contractor shall make the required changes at their own expense.

PART 8 – QUALIFICATIONS OF CONTRACTOR/WORKERS:

8.1 All Mechanical Contractors and their subcontractors bidding this project must have been a licensed company for a minimum of three (3) years to qualify to Bid this project. Individual employee experience does not supersede this requirement.

8.2 All mechanical subcontractors bidding the mechanical work must have completed one project of 70% this subcontract cost size and two projects of 50% this subcontract cost size.

8.3 All mechanical work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers, as evidenced by their workmanship, shall be summarily relieved of their responsibilities in areas of incompetency. The Engineer shall reserve the right to determine the quality of workmanship of any workers and unqualified or incompetent workers shall refrain from work in areas not deemed satisfactory. Requests for relief of workers shall be made through the normal channels of Architect, Contractor, etc.

8.4 The Contractor shall hold all required licenses in the State which the work is to be performed.

8.5 All plumbing work shall be accomplished by Journeymen Plumbers under the direct supervision of a Master Plumber as defined under State Plumbing Law Regulations and Code. Proof and Certification may be requested by the Engineer.

8.6 The installation of all Heating, Ventilating and Air-Conditioning Systems (HVAC) by any Contractor, whether in existing or new building construction shall be performed by a Licensed Master HVAC Contractor. This includes any Contractor installing HVAC systems, piping, and ductwork.

8.7 All sheet metal, insulation and pipe fitting work shall be installed by workers normally engaged in this type of work.

8.8 All automatic control systems shall be installed by workers normally engaged or employed in this type of work, except in the case of minor control requirements (residential type furnaces, packaged HVAC equipment with integral controls, etc.) in which case, if a competent worker is

the employee of this Contractor, the worker may be utilized subject to review of their qualifications by the Engineer and after written approval from same.

8.9 All special systems (Automatic Sprinkler Equipment, etc.) shall be installed only by workers normally engaged in such services. Exception to this specification may only be made in writing by the Engineer.

8.10 All electrical work shall be accomplished by Licensed Journeymen electricians under the direct supervision of a licensed Electrician. All applicable codes, utility company regulations, laws and permitting authority of the locality shall be fully complied with by the Contractor.

PART 9 – SUPERVISION OF WORK:

9.1 The Contractor shall personally supervise the work for which they are responsible or have a competent superintendent, approved by the Engineer, on the work at all times during progress with full authority to act on behalf of the Contractor.

PART 10 – CONDUCT OF WORKERS:

10.1 The Contractor shall be responsible for the conduct of all workers under their supervision. Misconduct on the part of any worker to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt removal of that worker. The consumption of alcoholic beverages or other intoxicants, narcotics, barbiturates, hallucinogens, or rehabilitating drugs on the job site is strictly forbidden.

PART 11 – COOPERATION AND COORDINATION WITH OTHER TRADES:

11.1 The Contractor shall give full cooperation to all other trades and shall furnish in writing with copies to the Engineer, any information necessary to permit the work of other trades to be installed satisfactorily and with the least possible interference or delay.

11.2 Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If so, directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than ¼" = 1'-0", clearly indicating how their work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. Make the necessary changes in the work to correct the condition without extra charge.

11.3 The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

PART 12 – GUARANTEES AND WARRANTIES:

12.1 The Contractor shall guarantee all equipment, apparatus, materials, and workmanship entering into their Contract to the best of its respective kind and shall replace all parts at their own expense, which are proven defective within the time frame outlined in the General Conditions of the Contract. The effective date of completion of the work shall be the date of the Project's Statement of Substantial Completion. Items of equipment which have longer guarantees, as called for in these Specifications, shall have warranties and guarantees completed in order, and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Engineer shall then submit these warranties, etc. to the Owner. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall not invalidate the guarantee except that the Owner shall be liable for any

damage to equipment during this period, due to negligence of their operator or other employees. Refer to other sections for any special or extra warranty requirements.

12.2 All gas fired heat exchangers shall have 15 year warranty.

12.3 Provide all warranty certificates to Owner. All warranties begin starting at the substantial completion date, submit warranty certificates accordingly.

PART 13 – COST BREAKDOWNS (SCHEDULE OF VALUES):

13.1 Within thirty (30) days after acceptance of the Contract, the Contractor shall furnish to the Engineer, one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made in a format approved by the Engineer. Payments will not be made until satisfactory cost breakdowns are submitted.

PART 14 – CHANGES IN MECHANICAL WORK:

14.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 15 – CLAIMS FOR EXTRA COST:

15.1 REFER TO GENERAL AND SPECIAL CONDITIONS.

PART 16 – MATERIALS AND WORKMANSHIP:

16.1 All equipment, materials and articles incorporated in the work shall be new and of comparable quality to that specified. Each Bidder/Proposer shall determine that the materials and/or equipment they propose to furnish can be brought into the building(s) and installed within the space available. In certain cases, it may be necessary to remove and replace walls, floors and/or ceilings and/or disassemble/reassemble the materials and equipment and this work shall be the responsibility of the Contractor, whether specifically initiated or not.

16.2 All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement of fans, motors, coils, filters, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s). Ensure, through coordination that no other Contractor seals off access to space required for equipment materials, etc.

16.3 Materials and equipment shall bear Underwriters' Laboratories label where such a standard has been established, where applicable.

16.4 Each length of pipe, fitting, trap, fixture, and device used in the plumbing or drainage systems shall be stamped or indelibly marked with the weight or quality thereof and with the manufacturer's mark or name.

16.5 All equipment shall bear the manufacturer's name and address. All electrically operated equipment shall bear a name plate indicating required horsepower, voltage, phase, and ampacity. Pumps and fans shall have a data plate indicating horsepower, pressure, and flow rate.

PART 17 – HAZARDOUS MATERIALS:

17.1 No asbestos or mercury containing materials shall be installed in this project.

PART 18 – TEMPORARY SERVICES:

18.1 The Contractor shall arrange any temporary water, electrical and other services which may be required to accomplish the work. Refer also to General and Special Conditions.

18.2 All temporary services shall be removed by Contractor prior to completion of work.

PART 19 – SURVEY, MEASUREMENTS AND GRADE:

19.1 The Contractor shall lay out their work and be responsible for all necessary lines, levels, inverts, elevations, and measurements. The Contractor must verify the figures shown on the Plans before laying out the work and will be held responsible for any error resulting from failure to do so.

19.2 The Contractor shall base all measurements, both horizontal and vertical from established benchmarks. All work shall agree with these established lines and levels. Verify all measurements at the site and check the correctness of same as related to the work.

19.3 Should the Contractor discover any discrepancy between actual measurements and those indicated which prevents following good practice or the intent of the contract documents, the Contractor shall promptly notify the Engineer and shall not proceed with this work until the Contractor has received instructions from the Engineer on the disposition of the work.

PART 20 – PROTECTION OF EQUIPMENT:

20.1 The Contractor shall be entirely responsible for all material and equipment they furnish in connection with their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. All piping, etc., shall be properly plugged or capped during construction in a manner approved by the Engineer. Equipment damaged, stolen, or vandalized while stored on site, either before or after installation, shall be repaired or replaced by the Contractor at their expense. All ductwork with open ends shall be covered with plastic during construction.

PART 21 – REQUIRED CLEARANCES FOR ELECTRICAL EQUIPMENT:

21.1 The NEC has specific required clearances above, in front, and around electrical gear, panels etc. The Contractor shall not install any piping, ductwork, etc., in the required clearance. If any appurtenance is located in the NEC required clearance, it shall be relocated at no additional cost. Coordinate with the Electrical Contractor prior to any work.

PART 22 – EQUIPMENT SUPPORT:

22.1 Each piece of equipment, apparatus, piping, or conduit suspended from the ceiling or mounted above the floor level shall be provided with suitable structural support, pipe stand, platform, or carrier in accordance with the best recognized practice. Such supporting or mounting means shall be provided by the Contractor for all equipment and piping. Exercise extreme care that structural members of building are not overloaded by such equipment. Provide any required additional bracing, cross members, angles, support, etc. Do not support items from roof/floor deck or bridging.

PART 23 – DUCT AND PIPE MOUNTING HEIGHTS:

23.1 All exposed or concealed ductwork, piping, etc., shall be held as high as possible unless otherwise noted and coordinated with all other trades. Exposed piping and ductwork shall, insofar as possible, run perpendicular or parallel to the building structure. Refer to Plans for

minimum heights of ducts and piping. Minimum height above ceilings shall be 6" clear including insulation, unless otherwise noted.

PART 24 – BROKEN LINES AND PROTECTION AGAINST FREEZING:

24.1 No conduits, piping, etc. carrying water or any other fluid subject to freezing shall be installed in any part of the building where danger of freezing may exist without adequate protection being given by the Contractor whether or not insulation is specified or indicated on the particular piping. All damages resulting from broken and/or leaking lines shall be replaced or repaired at the Contractor's own expense. Do not install piping across or near openings to the outside whether or not they are carrying static or moving fluids. Insulation on piping does not necessarily ensure that freezing will not occur. If in doubt, contact the Engineer.

PART 25 – WEATHERPROOFING:

25.1 Where any work pierces waterproofing including waterproof concrete, the method of installation shall be as specified and approved by the Architect and Engineer before work is performed. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings permanently watertight.

25.2 Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

PART 26 – FINAL CONNECTIONS TO EQUIPMENT:

26.1 The Contractor shall finally connect mechanical services (water, sanitary, gas, air, etc.), to any terminal equipment, appliances, kitchen equipment, etc., provided under this and/or other divisions of the work. Various equipment connections indicated are based upon "basis of design" equipment selections. Should alternate equipment be purchased by the General Contractor, then this Contractor shall make the necessary provisions in the Bid for any and all differences. Change Orders shall not be considered for any differences due to alternate equipment purchase. Such connections shall be made in strict accord with current codes, safety regulations and the equipment manufacturer's recommendations. If in doubt, contact the Engineer prior to installation.

PART 27 – ACCESSIBILITY:

27.1 The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in double partitions and ceilings for the proper installation of their work. They shall cooperate with all others whose work is in the same space. Such spaces and clearances shall, however, be kept to the minimum size required.

27.2 The Contractor shall locate and install all equipment so that it may be serviced and maintained as recommended by the manufacturer. Allow ready access and removal of the entire unit and/or parts such as valves, filters, fan belts, motors, prime shafts, controls, coils, etc.

27.3 Whether shown on the Plans or not, the Contractor shall provide in the Bid access panels for each concealed shut-off valve, motorized control damper, manual air damper or other device requiring service as shown on Engineer's Plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. Change orders for access panels will not be accepted.

PART 28 – SCAFFOLDING, RIGGING AND HOISTING:

28.1 The Contractor shall furnish all scaffolding, rigging, hoisting and services necessary for erection and delivery onto the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

PART 29 – CONCRETE WORK:

29.1 The Contractor shall be responsible for the provisions of all concrete work required for the installation of any of their systems or equipment. The Contractor may, at their option, arrange with the others to provide the work. This option, however, will not relieve the Contractor of their responsibilities relative to dimensions, quality of workmanship, locations, etc.

29.2 In the absence of other concrete Specifications, all concrete related to Mechanical work shall be 3500 psi minimum compression strength at 28 days curing, slump: 4” ± 1”, air entrainment 4.5% water to cement ratio 0.5 and shall conform to the standards of the American Concrete Institute Publication AC1-318. Heavy equipment shall not be installed on pads for at least seven (7) days after pour.

29.3 All concrete pads shall be complete with all pipe sleeves, anchor bolts, reinforcing steel, concrete, etc. as required. Pads larger than 18" in width shall be reinforced with ½" deformed round bars on 6" centers both ways. Bars shall be approximately 2" above the bottom of the pad. All parts of pads and foundations shall be properly rodded or vibrated. If exposed parts of the pads and foundations are rough or show honeycomb after removing forms, all surfaces shall be rubbed to a smooth surface. Chamfer all vertical edges ¾” and tool horizontal edges with ¾” radius.

29.4 In general, unless otherwise noted, concrete pads for equipment shall be 4” thick, extend six (6) inches beyond the equipment's base dimensions. Where necessary, extend pads 30 inches beyond base or overall dimensions to allow walking and servicing space. Insert 6-inch steel dowel rods into new and existing floors to anchor pads.

29.5 Exterior concrete pads shall be 8” thick with four (4) inches minimum above grade and four (4) inches below grade on a compacted four (4) inch dense grade rock base unless otherwise indicated or specified. Surfaces of all foundations and bases shall have a smooth finish with one-half (½) inch chamfer on exposed edges. Turn down edges 18” below grade.

PART 30 – RESTORATION OF NEW OR EXISTING LANDSCAPING, PAVING, SURFACES, ETC.:

30.1 The Contractor shall at their expense restore to their original conditions all paving, curbing, surfaces, drainage ditches, structures, fences, landscaping, existing or new building surfaces and appurtenances, and any other items damaged or removed by their operations. Replacement and repairs shall be in accordance with good construction practice; by qualified tradesman and shall match materials employed in the original construction of the item and shall be to the satisfaction of the Owner and/or Engineer.

PART 31 – MAINTENANCE OF EXISTING UTILITIES AND LINES:

31.1 The locations of all piping, conduits, cables, utilities, and manholes existing, or otherwise, that comes within the contract construction site, shall be subject to continuous uninterrupted service with no other exception than the Owner of the utilities permission to interrupt same temporarily. Provide a seven (7) day written notice to Engineer, Architect and Owner prior to interrupting any utility service or line.

31.2 Known utilities and lines as available to the Engineer are shown on the Plans. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain and mark all utilities or lines that would be endangered by the excavation. Hand dig if required to locate. Contractor shall bear costs of repairing damaged utilities.

31.3 If utilities or lines occur in the earth within the construction site, the Contractor shall probe and locate the lines prior to machine excavation in the respective area. Hand dig if required to locate.

31.4 Cutting into existing utilities and services shall be performed in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.

31.5 The Contractor shall repair to the satisfaction of the Owner and Engineer, any surfaces or subsurface improvements damaged during the course of the work, unless such improvement is shown to be abandoned or removed.

31.6 Machine excavation shall not be permitted with ten feet of gas lines, fuel lines, electrical lines or lines carrying combustible and/or explosive materials. Hand excavate only in accord with utility company, agency or other applicable laws, standards or regulations.

31.7 Protect all new or existing lines from damage by traffic, etc. during construction. Repairs or replacement of such damage shall be at the sole expense of the party responsible.

31.8 Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

PART 32 – CLEANING:

32.1 The Contractor shall, at all times, keep the area of their work presentable to the public and clear from rubbish and debris caused by their operations; and at the completion of the work, they shall remove all rubbish, debris, all of their tools, equipment, temporary work, and surplus materials from and about the premises, and shall leave the area clean and ready for use. If the Contractor does not attend to such cleaning upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the Contractor. The Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of their rubbish or debris.

32.2 After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of piping, equipment, fixtures and all other associated or adjacent fabrication.

32.3 Ductwork and piping shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4” above the floor and the open ends shall be completely covered in plastic. Open ends of installed ductwork shall be protected with plastic. Do not install the ductwork or insulation (pipe or duct) if the building is not “dried-in”. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

PART 33 – TEMPORARY USE OF EQUIPMENT:

33.1 The permanent heating and plumbing equipment, when installed, may be used for temporary services, with the consent of the Engineer. Use of the permanent equipment shall be dependent upon the cleanliness of the job site as determined by Owner, Architect and Engineer. Should the permanent systems be used for this purpose the Contractors shall make all temporary connections required at their expense. They shall also make any replacement required due to damage wear and tear, etc., leaving the same in "as new" condition.

33.2 Permission to use the permanent equipment does not relieve the Contractors from the responsibility for any damages to the building construction and/or equipment which might result because of its use.

33.3 Warranties shall begin at substantial completion regardless of temporary use of equipment or not.

33.4 A pre-start-up conference shall be held in accordance with EQUIPMENT/CONTROLS START-UP AND VERIFICATION in this section.

33.5 For rooftop units and existing HVAC systems during all phases of construction:

- At a minimum, four complete sets of filter media are required for each unit. In each unit, install two sets of filter media during construction (more shall be required if construction activities dictate more frequent changes). In each unit, install one set of filter media at substantial completion. Leave one set of filter media in boxes in appropriate mechanical room as a spare set for the Owner. All other filters shall be used by the Contractor during construction. Dispose of all construction filter media.
- On the outside of all return air openings install a minimum of two sets of fiberglass filter media, such as cheesecloth, to be utilized as pre-filters for the “construction” filters. Install first set upon start-up and then install second set when first set is dirty. Dispose of all dirty construction filters. Change filters as often as necessary to keep units from becoming dirty at no additional cost.
- At substantial completion of the project the entire unit shall be cleaned to present a like “new” unit for the Owner and all filters shall be replaced with new.

33.6 VRF and split units shall not be used for temporary heating and cooling.

PART 34 – NOISE, VIBRATION OR OSCILLATION:

34.1 All work shall operate under all conditions of load without any sound or vibration which is objectionable in the opinion of the Engineer. In case of moving machinery, sound, or vibration noticeable outside of room in which it is installed, or annoyingly noticeable inside its own room, will be considered objectionable. Sound or vibration conditions considered objectionable by the Engineer shall be corrected in an approved manner by the Contractor at their expense.

34.2 All equipment subject to vibration and/or oscillation shall be mounted on vibration supports whether indicated or not suitable for the purpose of minimizing noise and vibration transmission and shall be isolated from external connections such as piping, ducts, etc. by means of flexible connectors, vibration absorbers, or other approved means.

34.3 Unitary equipment, such as room units, exhaust fans, etc., shall be rigidly braced and mounted to wall, floor or ceiling as required and tightly gasketed and sealed to mounting surface to prevent air leakage and to obtain quiet operation. Flush and surface mounted equipment such as diffusers, grilles, etc., shall be gasketed and affixed tightly to their mounting surface.

34.4 The Contractor shall provide supports for all equipment they furnish. Supports shall be liberally sized and adequate to carry the load of the equipment and the loads of attached equipment, piping, etc. All equipment shall be securely fastened to the structure either directly or indirectly through supporting members by means of bolts or equally effective means. If strength of supporting structural members is questionable, contact Engineer.

PART 35 – EQUIPMENT/CONTROLS STARTUP & VERIFICATION:

35.1 The Contractor and their Subcontractors shall include in the bid to provide equipment and controls startup and verification for ALL Mechanical Systems specified for this project.

35.2 A pre-start-up conference shall be held with the Architect, Engineer, Owner, General Contractor, Mechanical Contractor, Electrical Contractor, Controls Contractor, Test and Balance Contractor, and the Manufacturer's providing startup services. The purpose of this meeting will be to discuss the goals, procedures, etc. for start-up.

35.3 Specific line-items shall be included on the schedule of values by each Trade for "equipment and controls startup". These line-item values shall be approved by the Engineer. The Engineer, Owner and the Engineer's Field Inspector(s) shall closely monitor progress and quality of the equipment and controls startup and may withhold pay requests as deemed appropriate until satisfactorily completed.

35.4 Specific startup/verification specifications are included throughout the Mechanical Specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians, not third party Contractors, and shall complete and submit start-up reports/checklists. The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner. Where factory start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up. All information shall be completed by the Contractor and submitted to the Owner/Engineer prior to acceptance of the equipment.

35.5 The Contractor shall be responsible for completion of System Verification Checklists/Manufacturer's Checklists. Factory startup is required for all HVAC equipment noted. Unless noted otherwise, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians and shall complete and submit start-up reports/checklists.

35.6 Except for the specific equipment specified in this Specification Section, the manufacturer's recommended startup procedures and checklists will be acceptable for use in the project. Where "manufacturer" startup is not specified, then this Contractor shall perform startup services in strict accordance with manufacturer's instructions. All startup/verification process shall be thoroughly documented by the Contractor and shall include the time and date when performed.

35.7 The Contractor shall "zip-tie" a start-up report to each piece of equipment in a clear plastic cover. Once start-up completion is verified by the Engineer the Contractor shall remove all reports and consolidate them into close-out documentation. The Contractor shall be responsible for completion of System Verification Checklist (SVC) / Manufacturer's Checklists.

PART 36 – INSPECTION, APPROVALS AND TESTS:

36.1 Before requesting a final review of the installation from the Architect and/or Engineer, each Contractor shall thoroughly inspect their installations to assure that the work is complete in every detail and that all requirements of the Contract Documents have been fulfilled. Failure to

accomplish this may result in charges from the Architect and/or Engineer for unnecessary and undue work on their part.

36.2 The Contractor shall provide as a part of this Contract any required Agency inspection, licensed and qualified to provide such services. All costs incidental to the provisions of inspections shall be borne by the Contractor.

36.3 The Contractor shall advise each Inspecting Agency in writing, with an informational copy of the correspondence to the Architect and/or Engineer, when they anticipate commencing the work. Inspections shall be scheduled for rough-in as well as finished work. The rough-in inspections shall be divided into as many inspections as may be necessary to cover all rough-in without fail. Failure of the Inspecting Agency to inspect the work in a timely manner and submit the related reports may result in the Contractor having to expose concealed work not so inspected. Such exposure will be at the expense of the responsible Contractor.

36.4 Approval by an Agency Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these Plans and Specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.

36.5 Before final acceptance, the Contractor shall furnish the original and three (3) copies of the certificates of final approval by the Agency Inspector to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

PART 37 - ABOVE-CEILING AND FINAL PUNCH LISTS:

37.1 The Contractor shall review each area and prepare and complete their own punch list for each of the subcontractors as required for the Project Schedule.

37.2 Seven (7) days notice shall be given to the Engineer for review of above ceiling work that will be concealed by tile or other materials. Seven (7) days notice shall be given to the Engineer for review of below ceiling work and final inspection.

37.3 When all work from the Contractor's punch list is complete at each of the major Project Stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing seven (7) days prior to the proposed date. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review. The Contractor’s representative may be requested at the inspections.

37.4 If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due net 10 days from date of each additional visit) at a rate of $125.00 per hour plus travel expense for extra trips required to complete either of the above ceiling, below ceiling or final punch lists.

PART 38 – OPERATING INSTRUCTIONS:

38.1 Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating the systems and equipment for a period of three (3) days of eight (8) hours each, or as otherwise specified. Refer to Section HVAC EQUIPMENT for additional requirements. During this period, instruct the Owner or their representatives fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least seven (7)

days written notice to the Owner, Architect and Engineer in advance of this training period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representatives that were present.

38.2 Each Contractor shall furnish three complete bound sets for approval to the Engineer instructions for operating and maintaining all systems and equipment included in this contract. All instructions shall be submitted in draft form, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions. Refer to Specification Section SHOP DRAWINGS for additional detail.

38.3 Each Contractor, in the above mentioned instructions, shall include the maintenance schedule for the principal items of equipment furnished under this contract and a detailed, easy to read parts list and the name and address of the nearest source of supply.

PART 39 – RECORD DRAWINGS:

39.1 The Contractor shall ensure that any deviations from the Design are as they occur recorded in red, erasable pencil on record drawings kept at the jobsite. The Engineer shall review the record documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Pay particular attention to the location of under floor sanitary and water lines, shut-off valves, cleanouts, and other appurtenances important to the maintenance and operation of Mechanical Systems. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose and deliver to the Engineer upon completion of the work.

PART 40 - COMMISSIONING: CONTRACTOR RESPONSIBILITIES:

40.1 Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

- Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
- Cooperate with the CxA for resolution of issues recorded in the Issues Log.
- Attend commissioning team meetings.
- Integrate and coordinate commissioning process activities with construction schedule.
- Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority.
- Review and accept commissioning process test procedures provided by the Commissioning Authority.
- Complete commissioning process test procedures.

END OF GENERAL PROVISIONS - MECHANICAL

SECTION 20 02 00 - SCOPE OF THE MECHANICAL WORK

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Mechanical work for this Contract shall include all labor, materials, equipment, fixtures, excavation, backfill and related items required to completely install, test, place in service and deliver to the Owner the complete mechanical systems in accordance with the accompanying plans and all provisions of these specifications. This work shall primarily include but is not necessarily limited to the following paragraphs.

1.3 All applicable services and work specified in GENERAL PROVISIONS - MECHANICAL.

1.4 Installation of all equipment per the manufacturer’s instruction, whether specifically detailed or not.

1.5 Provide all required motor starters, etc. not provided under the electrical sections.

1.6 Thorough instruction of the Owner’s maintenance personnel in the operation and maintenance of all mechanical equipment.

1.7 Thorough coordination of the installation of all piping, ductwork, equipment, and any other material with other trades to ensure no conflict in installation.

1.8 Approved supervision of the mechanical work.

1.9 Procurement of all required inspections, including fees for all inspection services and submission of final certificates of inspection to the Engineers.

1.10 Excavation, backfilling, cutting, patching, sleeving, concrete work, etc., required to construct the mechanical systems.

1.11 Equipment and controls start-up, verification and documentation as specified.

1.12 Record drawings, final inspection certificates, test results, O & M documentation, warranty certification, spare parts, and other specified closeout documentation.

1.13 Required schedule of values breakdown.

1.14 Pipe, duct, and equipment identifications.

1.15 Preinstallation meetings and equipment mockups.

1.16 Specified Commissioning activities.

1.17 Complete domestic water service to 5’-0” beyond building footprint. Refer to Civil Drawings/Specifications for additional requirements.

1.18 Complete sanitary sewer service to 5’-0” beyond building footprint. Refer to Civil Drawings/Specifications for additional requirements.

1.19 Complete storm sewer service to 5’-0” beyond building footprint. Refer to Civil Drawings/Specifications for additional requirements.

1.20 Complete fire protection service to 5’-0” beyond building footprint. Refer to Civil Drawings/Specifications for additional requirements.

1.21 Complete natural gas service to 5’-0” beyond building footprint. Refer to Civil Drawings/Specifications for additional requirements

1.22 Domestic hot, cold, and recirculating hot water system.

1.23 Soil, waste, and vent systems.

1.24 Roof drainage systems.

1.25 All plumbing equipment, fixtures, and fittings.

1.26 Automatic sprinkler systems.

1.27 Complete heating, ventilation, and air conditioning systems.

1.28 All mechanical exhaust systems.

1.29 All insulation associated with mechanical systems.

1.30 Condensate drainage systems.

1.31 All required pressure testing, flushing, purging, pressure and flow testing requirements.

1.32 Final coordination and connection of all mechanical equipment furnished by others (e.g., kitchen equipment, appliances, medical equipment).

1.33 Complete natural gas and propane piping systems.

1.34 All required controls, including self checkout and commissioning.

END OF THE SCOPE OF THE MECHANICAL WORK

SECTION 20 03 00 - SHOP DRAWINGS, MAINTENANCE MANUALS AND PARTS LISTS

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Contractor shall prepare and submit to the Engineer, through the Prime Contractor and the Architect within thirty (30) days after the date of the Contract, required copies of all shop drawings, certified equipment drawings, installation, operating and maintenance instructions, samples, wiring diagrams, etc. on all items of equipment specified hereinafter. Refer to Division 1 requirements for shop drawing submittal requirements.

1.3 Provide all shops in electronic/PDF format. The Engineer’s comments will be returned in electronic format.

1.4 Each shop drawing and/or manufacturers descriptive literature shall have the proper notation indicated on it selecting equipment, accessories and features and shall be clearly referenced to the specifications, schedules, fixture numbers, etc., so that the Engineer may readily determine what the Contractor proposes to furnish. All data and information schedules indicated or specified shall be noted on each copy of each submittal.

1.5 Submittal data shall include specification data including metal gauges, finishes, accessories, etc. Also, the submittal data shall include certified performance data, wiring diagrams, dimensional data, and a spare parts list. Submittal data shall be reviewed by the Engineer before any equipment or materials is ordered or any work is begun in the area requiring the equipment.

1.6 All submittal data shall have the stamp of approval of the Contractor submitting the data as well as the Prime Contractor and the Architect to show that the drawings have been reviewed by the Contractor. Any drawings submitted without these stamps of approval may not be considered and will be returned for proper resubmission.

1.7 The Contractor shall make any corrections or changes required by the Engineer and shall re-submit for final review as outlined above.

1.8 It shall be noted that review of shop drawings by the Engineer applies only to conformance with the design concept of the project and general compliance with the information given in the Contract Documents. In all cases, the Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located. The Contractor shall also coordinate piping side connections.

1.9 The Engineer’s review of shop drawings, schedules or other required submittal data shall not relieve the Contractor from responsibility for adaptability of the item to the project; compliance with applicable codes, rules, regulations, and information that pertains to fabrication and installation; dimensions. weight and quantities; electrical characteristics; and coordination of the work with all other trades involved in this project.

1.10 Prior to ordering any materials or rough-in of any kind, the Mechanical Contractor shall be responsible for final coordination of all electrical requirements (i.e. voltage, phase, circuit breaker, wire sizing, etc.) with the Electrical Contractor. There will be no change in the Contract Amount for any discrepancies. A final coordination meeting shall be held with the Architect, Owner, Engineer, Prime Contractor, Mechanical Contractor, Electrical Contractor, and their sub-contractors.

1.11 Equipment shall not be ordered and no final rough-in connections, etc., shall be accomplished until reviewed equipment shop drawings are in the hands of the Contractor. It shall be the Contractor's responsibility to obtain reviewed shop drawings and to make all connections, etc. in the neatest and most workmanlike manner possible. The Contractor shall coordinate with all the other trades having any connections, roughing-in, etc. to the equipment.

1.12 If the Contractor fails to comply with the requirements set forth above, the Engineer shall have the option of selecting any or all items listed in the Specifications or on the Drawings; and the Contractor shall be required to furnish all materials in accordance with this list.

1.13 Colors for equipment in other than mechanical spaces shall be selected from the Manufacturer's standard and factory optional colors unless noted otherwise on the Plans. Color samples shall be furnished with the shop drawing submission for such equipment.

1.14 All submittals for mechanical equipment shall include all information specified and scheduled. This shall include air and water pressure drops, RPM, noise data, face velocities, horsepower, voltage motor type, steel or aluminum construction, and all accessories clearly marked.

1.15 All items listed in the schedules shall be submitted for review in a tabular form similar to the equipment schedule. All items submitted shall be designated with the same identifying tag as specified on each sheet.

1.16 Any submittals received in an unorganized manner without options to be provided specifically noted and with incomplete data will be returned for resubmittal.

PART 2 – SHOP DRAWINGS:

2.1 Shop Drawings, descriptive literature, technical data and required schedules shall be submitted on the following:

Access Doors
Air Filtration & Components
Rooftop Units
VRF Systems (Indoor and Outdoor Units)
Domestic Water Heaters
Split Systems
VAV Boxes
Automatic Airflow Dampers
Ductwork Accessories/Volume Dampers
Exhaust Fans
Fire Protection Sprinkler System
Firestopping
Floor Drains
Insulation
Plumbing Fixtures, Fittings and Trim
Plumbing Specialties
Register, Grilles, Diffusers and Louvers

Roof Drains
System Verification Check Lists
Temperature Controls & Components
Valves
(Refer to the corresponding Special Notes.)

2.2 SPECIAL NOTES:

2.2.1 For all items above, upon substantial completion of the project, the Contractor shall deliver to the Engineer (in addition to the required Shop Drawings) three (3) complete copies of operation and maintenance instructions and parts lists for each item above. Where available, documents shall include at least:

- Detailed operating instructions
- Detailed maintenance instructions including preventive maintenance schedules.
- Addresses and phone numbers indicating where parts may be purchased.
- Expanded parts drawings, parts lists, service manuals, schematics, wiring diagrams.
- Master air filter list including equipment identification, filter size, filter quantity, and supplier contact information.
- Start-up reports, service records and test reports.

2.2.2 Shop drawings for the Temperature Control Systems shall include detailed, scaled plans and schematic diagrams indicating the function and operation of the system. Refer to Specification Section – CONTROLS for additional requirements.

2.2.3 Shop drawings for the Building Fire Protection System shall be prepared and stamped by a Certified Contractor and shall meet the criteria of the authority having jurisdiction and submitted to the Engineer. After the Engineer's review, they shall be submitted by the Contractor to the proper state authorities along with the required agency review fee. Refer to Specification Section – FIRE PROTECTION for additional requirements.

2.2.4 The Contractor shall submit shop drawings for the boilers along with all required supporting documentation and agency review fees to the authority having jurisdiction and receive approval prior to submittal to the Engineers.

2.2.5 The Contractor shall submit project specific UL listed firestopping installation drawings to the authority having jurisdiction where required for their approval as required.

END OF SHOP DRAWINGS, ETC.

SECTION 20 04 00 - DEMOLITION AND SALVAGE

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

2.1 It is the intent of this Section to completely remove all components of any existing mechanical system indicated in the mechanical drawings and items associated with the required architectural demolition specified in the Contract Documents. Also, any mechanical systems that will be open to view, or will interfere with the operations of the completed building, or which will, in any way, interfere with project construction shall be removed. The Contractor shall field verify existing conditions prior to bid.

PART 2 – PLUMBING DEMOLITION:

2.1 The general scope of the plumbing system demolition is indicated on the drawings. Where plumbing fixtures, equipment, etc. are removed, also remove all associated branch piping, hangers, insulation, concrete pads, controls, etc. Where plumbing fixtures are removed, all piping and services shall be removed in accordance with the current Building Code.

2.2 Refer to the demolition drawings for piping which shall be demolished or shall remain. If other piping is found during construction, which is not indicated on the drawings, the fixtures the piping serves must be identified. If it serves fixtures which are being demolished, the piping shall be removed back to the nearest mains and capped. Verify this work with the Engineer prior to demolition.

2.3 The Contractor shall be responsible for the removal and/or relocation of any plumbing equipment, concrete pads, piping, drain lines, vent lines, valves, fittings, etc., which may in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical or Electrical Systems specified in the Contract Documents. This work shall be performed at no increase in the contract price.

2.4 Unless otherwise indicated, the Contractor shall be responsible for patching and repairing by all qualified tradesmen, all holes, etc. in the ceilings, walls, roof, and floors where plumbing equipment is removed.

2.5 All underslab pipes abandoned in place shall be made safe in compliance with the Plumbing Code. Above slab piping is not allowed to be abandoned and must be removed.

2.6 All plumbing equipment not indicated to be reused shall be removed.

PART 3 – HVAC DEMOLITION:

3.1 The general scope of the HVAC system demolition is indicated on the drawings. Where HVAC units are removed, also remove all associated ductwork, branch piping, hangers, insulation, concrete pads, controls, etc.

3.2 Refer to the demolition drawings for equipment, piping, and ductwork to be demolished or which shall remain. If other equipment, piping, or ductwork is found during construction which is not indicated on the drawings, it must be determined if these systems serve other areas not being renovated. If the equipment piping and ductwork serve only renovated areas, the system shall be demolished. Verify this work with the Engineer prior to demolition.

3.3 Remove all temperature controls, panels, accessories, etc. that are accessible or become accessible during construction that serves demolished systems. Remove all pneumatic control tubing, control wiring and conduits in the facility unless noted otherwise.

3.4 The Contractor shall be responsible for the removal and/or relocation of any HVAC piping, equipment, fittings, valves, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Structural, Mechanical or Electrical Systems specified in the Contract Documents at no increase in the contract price.

3.5 Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing by qualified tradesmen of all holes, etc. in the ceiling, wall, roof, and floors where HVAC equipment is removed.

3.6 Where piping and ductwork systems are partially demolished, cap systems air and watertight and insulate. All capping of duct systems shall be completed with 22 gauge sheet metal and insulated. Seal with duct sealant.

PART 4 – REFRIGERANT RECOVERY:

4.1 The Contractor shall have a licensed refrigerant recovery technician evacuate all refrigerants from all refrigeration equipment being removed in accordance with EPA guidelines and regulations. The Contractor shall take all necessary precautions to not accidentally vent refrigerants to the atmosphere. The refrigerant shall become the property of the Contractor.

PART 5 – SALVAGE:

5.1 It is the intent of this section to deliver to the Owner all components which may be economically reused by them. The Contractor shall make every effort to remove reusable components without damage.

5.2 Components to be delivered to the Owner shall be specifically identified by the Owner's representative prior to beginning the demolition. The Contractor shall prepare a letter of transmittal of all salvaged items and obtain the Owner's signature and date of receipt.

5.3 Other items become the property of the Contractor and are to be removed from the site and disposed of properly.

END OF DEMOLITION AND SALVAGE

SECTION 20 11 00 - SLEEVING, CUTTING, PATCHING, REPAIRING AND FIRESTOPPING

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS – MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Contractor shall be responsible for all openings, sleeves, trenches, etc., that may be required in floors, roofs, ceilings, walls, etc., and shall coordinate all such work with the General Contractor and all other trades. Coordinate with the General Contractor, any openings which they are to provide before submitting a bid proposal in order to avoid conflict and disagreement during construction. Improperly located openings shall be reworked at the expense of the Contractor.

1.3 The Contractor shall plan their work ahead and shall place sleeves, frames or forms through all walls, floors and ceilings during the initial construction, where it is necessary for piping, ductwork, conduit, etc., to route through; however, when this is not coordinated, the Contractor shall then do all cutting and patching required for the installation of their work, or pay other trades for doing this work when so directed by the Engineer. Any damage caused to the building by this Contractor shall be corrected or rectified at their expense.

1.4 The Contractor shall notify other trades in due time where they will require openings or chases in new concrete, masonry, etc. Set all concrete inserts and sleeves for their work. Failing to coordinate, Contractor shall cut openings for the work and patch same as required at their expense with qualified tradesman.

1.5 The Contractor shall be responsible for properly shoring, bracing, supporting, etc., any existing and/or new construction to guard against cracking, settling, collapsing, displacing, or weakening while openings are being made. Any damage occurring to the existing and/or new structures, due to failure to exercise proper precautions or due to action of the elements shall be promptly and properly corrected to the satisfaction of the Engineer.

1.6 All work improperly performed or not performed as required in this section, shall be corrected by the General Contractor at the responsible Contractor’s expense.

PART 2 – SLEEVES:

2.1 Cast iron or Schedule 40 steel sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking between pipe and sleeve for water proofing. Horizontal sleeves passing through exterior walls or where there is a possibility of water leakage and damage shall be caulked watertight. Utilize “Link-Seal” at these locations.

2.2 In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter plus insulation. Sleeves through walls and floors shall be cut off flush with inside surface unless otherwise indicated.

2.3 Vertical sleeves in roofs shall be flashed and counterflashed with lead (4 lb.) or 16 oz. copper and welded or soldered to piping, lapped over sleeve and properly weather sealed. Where sleeves pass through roof construction, sleeves shall extend minimum of 12" above the roof.

2.4 Cast iron or Schedule 40 steel sleeves shall be installed through all walls where pipe enters the building below grade. Sleeves shall be flush with each face of the wall and shall be sufficiently larger than the entering pipe to permit thorough caulking between pipe and sleeve for water proofing. Horizontal sleeves passing through exterior walls or where there is a possibility of water leakage and damage shall be caulked watertight. Utilize “Link-Seal” at these locations.

2.5 Provide pipe sleeves through all interior wall penetrations. Sleeve shall be cast iron or schedule 40 steel. In all cases, sleeves shall be at least two pipe sizes larger than nominal pipe diameter plus insulation. Sleeves through walls and floors shall be cut off flush with inside surface unless otherwise indicated. Reference Part 5 for firestopping requirements in rated walls. Sleeves and annular space between pipe and sleeve in non-rated walls shall be sealed completely with acoustical non-shrink caulk.

2.6 Vertical sleeves in roofs shall be flashed and counterflashed with lead (4 lb.) or 16 oz. copper and welded or soldered to piping, lapped over sleeve and properly weather sealed. Where sleeves pass through roof construction, sleeves shall extend minimum of 12" above the roof.

PART 3 – CUTTING:

3.1 All openings in plaster, gypsum board or similar materials, shall be framed by means of plaster frames, casing beads, or angle members as required. The intent of this requirement is to provide smooth, even termination of wall, floor, and ceiling finishes as well as to provide a fastening means for devices, etc.

3.2 The Mechanical Contractor shall coordinate all openings in masonry walls with the General Contractor; and, unless otherwise indicated in the Contract Documents, shall provide lintels for all openings required for the mechanical work such as louvers, exhaust fans, etc. Prime paint all lintels. Lintels shall be sized as follows: Unless noted otherwise in the Structural Drawings.

3.2.1 New Openings under 48" in width: Provide one 3½"x3½"x3/8" steel angle for each 4" of masonry width. Lintel shall have 8" bearing on each end.

3.2.2 New Openings over 48" in width: Consult with Structural Engineer.

3.3 No cutting shall be performed at location that will weaken the structure and unnecessary cutting must be avoided. If in doubt, contact the Engineer.

3.4 Pipe openings in slabs and walls shall be cut with core drill. Hammer devices will not be permitted. Edges of trenches and large openings shall be scribe-cut with a masonry saw.

PART 4 – PATCHING, REPAIRING AND FINISHING:

4.1 Patching and repairing made necessary by work performed under this Division shall be included as a part of the work and shall be done by skilled workers of the trade. The work shall be performed in strict accordance with the provisions herein before specified to match adjacent surfaces and in a manner acceptable to the Engineer.

4.2 Where portions of existing sites, lawns, shrubs, paving, etc. are disturbed for installation of work of this Division, such items shall be repaired and/or replaced back to original or better condition to the satisfaction of the Engineer.

4.3 Piping and ductwork passing through floors, ceilings and walls in finished areas shall be fitted with chrome plated brass escutcheon trim pieces of sufficient outside diameter to amply cover the sleeved openings and an inside diameter to closely fit the pipe/duct around which it is installed.

4.4 Flanged metal collars shall be provided around all ducts, flues, pipes, etc. at all wall penetrations, both sides. Penetrations through any wall will require the installation of flanged collars. Openings shall not be any larger than 2" in any direction than the piping/duct passing through the wall. Openings larger than this requirement shall also be infilled to match adjacent construction. Fill void with insulation for sound reduction.

PART 5 – FIRESTOPPING:

5.1 Provide shop drawings indicating penetration detail for each type of wall and floor construction. Shop drawings must be specific for each individual type of penetration (one hour fire rated gypsum wall board with insulated metal pipe penetration, etc.) Provide copies to the authority having jurisdiction if required.

5.2 All mechanical pipes and ducts penetrating fire rated floors and walls shall be firestopped by this Contractor. All firestopping products and assemblies installed shall be UL listed.

5.3 Where the installation of conduit, ducts, piping, etc. requires the penetration of fire or smoke rated walls, ceilings or floors, the space around such conduit, duct, pipe, etc., shall be tightly filled with an approved non-combustible fire insulating material and properly sealed to maintain the rating integrity of the wall, floor or ceilings affected.

5.4 Where the installation of ductwork requires the penetration of non-rated floors, the space around the duct or pipe shall be tightly filled with an approved non-combustible material.

5.5 The manufacturer of the firestopping materials shall provide onsite training for the installing Contractor. The training session shall demonstrate to the Contractor the proper installation techniques for all the firestopping materials.

5.6 Firestopping materials include (but are not limited to) wraps, strips, caulks, moldable putties, restricting collars with steel hose clamps, damming materials, composite sheets, fire dam caulks, steel sleeves, etc.

5.7 The following indicates the 3M penetration details for uninsulated pipe penetration of various wall and floor construction types (the list is not inclusive):

- One, two or three hour fire rated concrete floor - 3M #5300-MPC8.
- One, two or three hour fire rated solid or block concrete wall - 3M #5300-MPC16 or 3M #5300-MPC26.
- One hour fire rated gypsum wallboard - 3M #5300-MPC7.
- Two hour fire rated gypsum wallboard - 3M #5300-MPC7.

5.8 The following indicates the 3M penetration details for insulated pipe penetrations of various wall and floor construction types (the list is not inclusive):

- One, two and three hour fire rated concrete floor - 3M #5300-IMP2.
- One, two and three hour concrete block wall - 3M #5300-IMP2.
- One hour fire rated gypsum wallboard - 3M #5300-IMP4.
- Two hour fire rated gypsum wallboard - 3M #IMP7.

5.9 HVAC ducts penetrating a one or two hour fire rated wall or floor shall be firestopped per 3M #5300-HVD1.

5.10 Multiple pipes penetrating fire rated floors and walls may be firestopped as a group. Submit details for specific applications if this method of firestopping is chosen.

END OF SLEEVING, CUTTING, PATCHING, ETC.

SECTION 20 12 00 - EXCAVATION, TRENCHING, BACKFILLING AND GRADING

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Contractor shall include all excavating, filling, grading, and related items required to complete their work as shown on the drawings and specified herein or as required to complete, connect, and place all mechanical systems in satisfactory operation.

PART 2 – EARTHWORK CLASSIFICATION:

2.1 Without regard to the materials encountered, all excavation and materials excavated shall be unclassified. Materials to be excavated shall include earth, rock, concrete, or any other obstructions encountered in excavation and/or trenching to install underground utility pipes, tanks, vaults, or other equipment.

2.2 Include all costs for rock removal, including mass rock and trench rock in the bids. No adjustment in the contract sum will be made on account of the presence or absence of rock, shale, debris, obstructions, or other materials encountered in the excavating. The Contractor shall be responsible for the removal of all materials encountered as required for the installation of the work.

2.3 It shall be distinctly understood that references to rock, earth, topsoil or any other excavated or non-excavated material or other material on the construction plans, cross section, contract documents, technical specification, or provisions, whether in numbers, words, letters, lines or graphically shown, is solely for information for the Engineer and Owner. This information shall not be taken as an indication of the classification of the material to be excavated, bored, or removed by any method, including drilling and blasting, or materials not removed. This information shall not be taken as to the quantity of either rock, earth, topsoil, or any other material involved, or the quality of the material such as hardness, wetness, workability, or suitability of the material either during excavation and construction or as a material to be reused during construction.

2.4 The Contractor shall draw their own conclusions as to the surface and sub-surface conditions to be encountered during construction of this project. The Engineer and Owner do not give any guarantee or warranty as to the accuracy of the data shown and no claim will be considered for additional compensation when the materials encountered are not in accord with the information shown.

2.5 Refer to Specification Division EARTHWORK located in the Site Work portions of the Specifications and Civil Drawings for additional information. Also refer to the GEOTECHNICAL report (provided for informational purposes only) included in the Front End of the Specifications.

PART 3 – EXCAVATION:

3.1 Unless otherwise shown or required, provide separate trenches for sewers, water lines and other underground raceways, with a minimum of 10 feet measured from outside diameter between pipes. In locations, such as close to buildings where separate trenches for sewers and water

lines are impractical, lay the water pipe on a solid shelf at least 2'-0" above the top of the sewer and 2'-0" to the side.

3.2 Water lines crossing under sewer lines, or crossing less than 2 feet above sewer lines, must be concrete encased for a distance not less than 5 feet on either side of the point of crossover.

3.3 Excavate trenches of sufficient width for proper installation of the work. Excavate to 6" below the bottom of new pipes for installation of compacted fill.

3.4 Sheet and brace trenches as necessary to protect workers and adjacent structures. Comply with local regulations or, in the absence thereof, with the latest version of "Manual of Accident Prevention in Construction" by the Associated General Contractors of America and current OSHA Standards. Do not remove sheeting until trench is backfilled sufficiently to protect pipe and/or equipment and prevent injurious caving. Where removal of sheeting and/or bracing is hazardous, leave in place. Cut off such sheeting not to be removed at least 3 feet below finished grade.

3.5 Rules and regulations governing the respective utilities shall be observed in executing all work under this Division. Active utilities discovered in the course of excavation shall be protected or relocated in accordance with written instructions from the Engineer. Inactive and abandoned utilities encountered in trenching operations shall be removed and abandoned with ends plugged or capped in accord with current codes and safe practice. If in doubt, contact Engineer.

3.6 Machine excavation shall not be allowed within ten (10) feet of electric lines, natural gas lines or other lines carrying combustible materials. Use only hand tool excavation methods.

3.7 The removal of rock shall be accomplished by use of hand or power tools only. Blasting shall not be permitted. Any damage to existing structures, piping services, or rock intended for bearing, shall be corrected at the responsible Contractor's expense.

3.8 Perform final grading of trench bottoms by hand tools; carry machine excavation only to such depth that soil bearing for pipes and raceways will not be disturbed. Grade the bottom of trenches evenly to ensure uniform bearing for all piping and raceways. Cut bell holes as necessary for joints and jointmaking. Except as hereinafter specified, bottom of trenches for bell and spigot pipe, flanged pipe, etc. shall be shaped to the lower quadrant of pipe with additional excavation for bell or flange. Piping installed where it rests on bell or flange and/or is supported with blocks or wedges will not be accepted.

3.9 Keep trenches free from water while construction is in progress. Under no circumstances lay pipe or appurtenances in water. Pump or bail water from bell holes to permit proper joining of pipe. Any dewatering from this Contractor's trenches which is required during construction, shall be included in this Contract.

3.10 In no case shall excavation work be accomplished that will damage in any way the new structure, existing structures, equipment, utility lines, landscaping to remain, etc. The Contractor shall take the necessary steps to prevent flow of eroded earth by water or landslide onto the property of others, or against the structures. The repair of all such damage or any other damage incurred in the course of excavation shall be at the responsible Contractor’s expense.

3.11 Use surveyor's level to establish elevations and grades.

3.12 Machine excavation shall be held a sufficient distance from foundations and footings to ensure no damage to same. Contractor shall accept full responsibility and pay for repairs and/or replacement of structural members, footings, etc.

3.13 The Contractor shall accept the site as it is. Remove all trash, rubbish, and unsuitable material from the site at the completion of excavation work.

3.14 The Contractor shall provide and maintain barricades, trench plates and temporary bridges around excavations as required for safety. Temporary plates or bridges shall be provided where excavations cross paved areas and walks. The Contractor shall maintain these plates and bridges in a safe and passable condition for all traffic until removal. Refer to OSHA Standards for such installations and comply with same in all details.

3.15 Pay particular attention to existing utilities and lines to avoid damage. The locations of existing lines which are indicated on the plans were taken unconfirmed from drawings prepared for previous construction and locations are approximate only. Also, certain water, gas, electric, storm and sanitary sewer lines and other underground appurtenances, active or abandoned, may not appear on the drawings. It shall be each Contractor's responsibility to ascertain the location of all lines and excavate with caution in their area.

3.16 Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor’s expense.

3.17 Maintain carefully all benchmarks, monuments and other reference points. If disturbed or destroyed, replace as directed.

PART 4 – BACKFILL, COMPACTION AND SURFACE REPAIR:

4.1 Backfilling for Mechanical Work shall include all trenches, manhole pits, tanks and/or any other earth and/or rock openings which are excavated under this Contract. Backfilling shall be carefully performed, and the surface restored to its original level to receive new finish. Wherever trenches and earth openings have not been properly filled and/or settlement occurs, they shall be re-excavated, re-filled and properly compacted, smoothed off and finally made to conform to the level of the original ground surface.

4.2 All trenches shall be backfilled with a bedding of 6" of manufactured sand or #8 crushed stone after finished excavation. Install the new pipe on the compacted fill material. Install tracer wire on all pipe. Apply any special coatings to the pipe. Also perform all required pressure tests and check the grade of the pipe to ensure that it is correct and free of swags, bows, or bends. Once coatings and testing are complete, backfill the pipe bed to 12" above the top of the pipe with specified compacted fill material. Backfill the remainder of the trench with earth (rock and debris free) tamped at 6" intervals. Water settling of backfill is permitted only as an aid to mechanical compacting.

4.3 Backfill and compact beneath areas to be seeded or sodded within six (6) inches of finished grade. The remaining six (6) inches shall be backfilled with clean top soil.

4.4 Backfill and compact beneath concrete slabs, paved areas, walks, etc. shall be brought to proper grade to receive the sub-base, concrete slab, or paving. No concrete or paving shall be placed on uncompacted fill or unstable soil.

4.5 Wherever, in the opinion of the Engineer, the soil at or below the requisite pipe grade is unsuitable for supporting piping, special support shall be provided as directed by the Engineer.

4.6 Backfill and compaction for natural gas lines shall be in strict accordance with the local utility company or local municipality’s requirements. If in doubt, contact the utility company or local municipality.

4.7 Unsuitable material and surplus excavated material not required for backfill shall be removed from the site. The location of dump and length of haul shall be the affected Contractor's responsibility.

4.8 Provide and place any additional fill material from off the site as may be required for backfill. Fill obtained from offsite shall be of kind and quality as specified for backfill and the source approved by the Engineer and shall be brought to the site by the Contractor requiring the fill.

4.9 If not specified or indicated elsewhere in the Contract Documents to be performed by Others, the Contractor shall lay new sod over their excavation work for existing disturbed grassy areas. Level, with adjacent surface, compact and water in accord with sound sodding practice.

4.10 Control soil compaction during construction providing minimum percentage of density specified for each area classification indicated in the following two paragraphs.

4.11 At a minimum, fill in grass areas shall be compacted to 90% Standard Proctor Density, ASTM D-698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content or as specified in Specification Division EARTHWORK; whichever is most stringent.

4.12 At a minimum, fill in concrete or asphalt area shall be compacted to 98% Standard Proctor Density, ASTM D-698, at moisture content between 2 percent below to a 3 percent above the optimum moisture content or as specified in Specification Division EARTHWORK; whichever is most stringent.

4.13 Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Take care to prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

4.14 All materials used for backfill around structures shall be of a quality acceptable to the Engineer and shall be free from large or frozen lumps, large rocks, wood, and other extraneous material. All spaces excavated and not occupied by footings, foundations, walls, or other permanent work shall be refilled with earth up to the surface of the surrounding ground, unless otherwise specified, with sufficient allowance for settlement.

4.15 In making the fills and terraces around the structures, the fill shall be placed in layers not exceeding 8 inches in depth and shall be kept smooth as the work progresses. Each layer of the fill shall be compacted. Sections of the fill immediately adjacent to buildings or structures shall be thoroughly compacted by means of mechanical tamping or hand tamping as may be required by the conditions encountered. All fills shall be placed so as to load structure symmetrically.

4.16 Rough grading shall be held below finished grade and then the topsoil which has been stockpiled shall be evenly spread over the surface. The grading shall be brought to the levels as specified. Final dressing shall be accomplished by hand work or machine work, or a combination of these methods as may be necessary to produce a uniform and smooth finish to all parts of the regrade. The surface shall be free from clods greater than one inch in diameter. Excavated rock (1” and smaller) may be placed in the fills, but is shall be thoroughly covered. Rock placed in fills shall not be closer than 24 inches from finished grade. Refer to Specification Division EARTHWORK.

4.17 Maintenance Settling: Where settling is measurable or observable at excavated areas during Project Warranty Period, remove surface (pavement, concrete or any other surface or finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration.

4.18 Disposal of Excess Non-organic Soil and Rock: Any excess excavated waste material shall become the property of the Contractor and shall be disposed of by the Contractor off site at no additional cost to the Owner.

4.19 Unless otherwise directed by the Owner during construction, excess topsoil, and subsoil suitable for fill shall be disposed of by the Contractor off site at no additional cost to the Owner.

PART 5 – MINIMUM DEPTHS OF BURY TO TOP OF PIPE:

5.1 In the absence of other indication, the following shall be the minimum depth of bury to top of pipe of exterior utility lines. Check drawings for variations.

5.1.1	Domestic Water Lines	36 inches below final grade.
5.1.2	Fire Service Lines	48 inches below final grade.
5.1.3	Storm Lines	24 inches below final grade.
5.1.4	Sanitary Lines	36 inches below final grade.
5.1.5	All Other Lines Not Listed	36 inches below final grade.

END OF EXCAVATION, TRENCHING, BACKFILLING, ETC.

SECTION 20 13 00 - PIPE, PIPE FITTINGS AND PIPE SUPPORT

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 Each Contractor's attention is also directed to Specification Section HANGERS, CLAMPS, ATTACHMENTS, ETC.

1.3 Unless otherwise indicated, all materials shall be new and of the best grade and quality for the type specified. Materials shall comply with the “Buy American Act”.

1.4 Where piping is not indicated on the plans, but is obviously or apparently required, contact the Engineer prior to submission of the bid.

1.5 All piping shall be capped or plugged during erection as required to keep clean and debris and moisture free.

1.6 The piping indicated shall be installed complete and shall be of the size indicated. When a pipe size is not indicated, the Contractor shall request the pipe size from the Engineer. Where a section of piping is not indicated but is obviously required for completion of the system, the Contractor shall provide same at no additional cost to the project.

1.7 All piping shall be installed straight and true, parallel, or perpendicular to the building construction. Piping shall be installed to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers, and other building openings.

1.8 All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on hangers. Vertical risers shall be supported at each floor line with approved steel pipe riser clamps. Spacing of pipe supports shall not exceed eight (8) foot intervals for pipes 3” and smaller and ten (10) foot intervals on all other piping. Small vertical pipes (1” and less) shall be bracketed to walls, structural members, etc. at four (4) foot intervals to prevent vibration or damage by occupants.

1.9 Insulated piping shall be supported on a rigid insulation block at each hanger to prevent crushing of insulation by hangers. Hangers shall pass completely around the insulation jacket and a steel protective saddle shall be applied to prevent compression of the insulation. Refer to Specification Section INSULATION - MECHANICAL.

1.10 The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted.

1.11 In metal buildings or buildings with light gauge trusses, support piping with standard pipe hangers with C-clamp connection to main structural members (not perlins), use angle steel cross pieces between main structural members where required to provide rigid support.

1.12 Where piping rests directly on a hanger, clip, bracket or other means of support, the support element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe to rest on ferrous structural members, equipment, etc. without electrolytic isolation. This includes temporary support required during Construction.

1.13 In general, piping shall be installed concealed except in mechanical rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceilings shall be held as high as possible and shall run so as to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur, they shall be kept as close to walls as possible.

1.14 Pipe shall be cut accurately to measurements established at the building by the Contractor and worked into place without springing or forcing. All pipes shall be reamed to full pipe diameter before joining and before assembling. All lengths of pipe shall be set vertically and tapped with a hammer to remove scale and dust and inspected to ensure that no foreign matter is lodged therein.

1.15 All hot and cold water piping shall be kept a sufficient distance apart so as to prevent heat transfer between them. Cold water piping shall also be kept apart from refrigerant hot gas lines.

1.16 Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing. If in doubt, consult Engineer.

1.17 Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If in doubt, consult Engineer.

1.18 Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished without use of insulating unions and permission of the Engineers.

1.19 Dielectric couplings or through ways shall be provided at all connections of dissimilar materials.

1.20 Nipples shall be of the same material, composition, and weight classification as pipe with which installed.

1.21 Apply approved pipe dope for service intended to all male threaded joints. The dope shall be listed for intended use.

1.22 Eccentric reducers shall be used where required to permit proper drainage and venting of pipe lines; bushings shall not be permitted.

1.23 High points of closed loop chilled and hot water systems shall have manual air vents as required unless automatic air vents are specifically indicated. Pipe to suitable drainage point.

1.24 Installation of pipe shall be in such a manner as to provide complete drainage of the system, whether detailed or not on plans. Drain valves shall be provided at all drainage points on pipes. Drain valves shall be ½" size ball valves with 3/4" hose thread end and vacuum breaker. Label each drain valve.

1.25 Where plastic piping penetrates a fire rated assembly, it shall be replaced with a threaded metal adapter and metal pipe or whatever means necessary to maintain the separation rating in accordance with local plumbing and fire codes.

1.26 Plastic piping or any material with a flame and smoke spread rating not approved for plenum use shall not be permitted in supply, return, relief, or exhaust plenums.

1.27 All increases in vent size at roof shall be by means of service weight cast iron increasers.

1.28 Non-metallic piping shall be installed in strict accordance with the manufacturer's instructions. If no such instructions are available, consult Engineer.

1.29 When running any type of pipe below a footing, perpendicular to the footing, the area underneath the footing and in the zone of influence shall be backfilled with concrete. The zone of influence is the area within a 45 degree angle projecting down from the top edge of footing on all sides of the footing.

1.30 When running any type of pipe below a footing, parallel to the footing, the area underneath the zone of influence shall be backfilled with 4” of crushed stone or sand bedding under the pipe. Each pipe section shall be anchored into unexcavated earth on both ends with deadman anchor system. The remainder of the trench in the zone of influence shall be backfilled with cementitious flowable fill. The zone of influence is the area within a 45 degree angle projecting down from the top edge of the footing on all sides of the footing.

1.31 Piping for all drainage systems shall be installed to permit flow, trapping, and venting in accord with current codes and best practice.

1.32 Install all gas piping per NFPA54. Union or valves shall not be installed in an air plenum. Piping below slab must be sleeved and vented. Piping installed in contained non-vented areas shall not have mechanical joints.

1.33 The entire domestic hot, cold, and recirculating hot water piping system shall be sterilized in strict accord with requirements of the Department of Health Codes, Rules, and Regulations for the State in which the work is being accomplished.

1.34 Site water piping utilized for domestic service shall be filled, cleaned, and disinfected. Disinfection shall utilize chlorine per the local water company standards or approved equal. Hyper-chlorinated water shall be discharged and diluted at the end of the pipeline into the sanitary sewers per local utility regulations.

1.35 The entire sanitary waste and vent piping system within the building shall be air-tight. If any sewer gases are present within the building, it shall be the Contractor’s responsibility to locate and correct any leaks and retest as required. Any sewer odor issues that occur during the Warranty Period shall be corrected by the Contractor.

1.36 Refrigerant piping must be installed to meet the HVAC equipment manufacturer’s requirements. A refrigerant piping schematic shall be obtained from the equipment manufacturer which indicates pipe sizes, valves, traps, sight glasses and other required refrigerant specialties. While installing or soldering refrigerant lines, the piping system must be continuously purged with nitrogen. After the piping system is installed, the refrigerant system must be evacuated to 25 microns for eight hours. Contact Engineer 36 hours prior to installation of refrigerant lines or evacuation of refrigerant system.

1.37 When connecting to an existing hydronic water system (chilled, hot, geothermal, etc.) or domestic water system, the Contractor shall include cost to drain the existing piping system and refill with water/closed loop chemicals to match existing fluid. If the building is occupied, and the drain down will affect services to these occupied areas, then the systems shall be drained and refilled over a weekend at a time acceptable to the Owner. Refer to Specification Section PIPE FILLING, CLEANING, FLUSHING, PURGING AND CHEMICAL TREATMENT.

PART 2 – UNIONS, FLANGES AND WELDED TEES:

2.1 Screwed unions, soldered unions or bolted flanges shall be provided as required to permit removal of equipment, valves, and piping accessories from the piping system. Keep adequate clearances for coil removal, rodding, tube replacement, motor lubrication, filter replacement, etc. Flanged joints shall be assembled with appropriate flanges, gaskets, and bolting. The clearance between flange faces shall be such that the connections can be gasketed and bolted tight without imposing undue strain on the piping system.

2.2 Dielectric insulating couplings or though ways shall be used wherever the adjoining materials being connected are of dissimilar metals such as connections between copper and steel pipe.

2.3 Tee connections for welded pipe shall be assembled with welding fittings. Where the size of the side outlet is such that a different connection technique than on the run is required, a weldolet, sockolet, or threadolet type fitting may be used for the branch in place of reducing tees only where the branch is 2/3 the run size or smaller. Weld-o-let and thread-o-let branch connections are acceptable.

PART 3 – SPECIFICATIONS STANDARDS:

3.1 All piping and material shall be new, comply with the “Buy American Act” and shall conform to the following minimum applicable standards:

- Steel pipe; Schedule 40; ASTM A-53.
- Copper tube; Type K, L, M; ASTM B88-62; Type DWV ASTM B306-62.
- Cast iron soil pipe; ASA A-40.l and CS 188-59.
- Cast iron drainage fittings; ASA B16.12.
- Cast iron screwed fittings; ASA B16.4.
- Welding fittings; ASA B16.9.
- Cast brass and wrought copper fittings; ASA B16.18.
- Cast brass drainage fittings; ASA B16.23.
- PVC pipe; Schedule 40; ASTM D-1785.
- PVC pipe; Schedule 40; ASTM D2665 and D1784. Piping must be installed in compliance to the manufacturer’s recommendations which shall be made available to the plumbing inspector.

PART 4 – PIPE TESTING AND CLEANING:

4.1 Piping shall be tested before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory.

4.2 Water piping systems shall be subjected to a hydrostatic test of 150 psi. The system shall be proven tight after a twenty-four (24) hour test.

4.3 The house drain line, interior storm sewers, interior rain water conductors, and all soil, waste and vent piping shall be subjected to a hydrostatic test of not less than a 10-foot head or an air test of not less than 5 psi and shall hold for 15 minutes.

4.4 Exterior sewer lines to the termination point outside the building shall be subject to a ten-foot hydrostatic test or an approved smoke test. These lines shall be subjected to a second test after 2 feet of backfill has been properly installed.

4.5 After fixtures have been installed, the entire plumbing system, exclusive of the house sewer, shall be subjected to an air pressure test equivalent to one inch water column and proven tight. The Contractor responsible shall furnish and install all of the test tees required, including those for isolating any portion of the system for tests.

4.6 The Contractor shall perform all additional tests that may be required by the Department of Health or other governing agency.

4.7 Any leaks or imperfections found shall be corrected and a new test run until satisfactory results are obtained. The cost of repair or restoration of surfaces damaged by leaks in any system shall be borne by the Contractor.

4.8 The natural gas service shall be tested in accordance with requirements and/or recommendations of the local gas company.

4.9 Natural gas piping downstream of the meter assembly shall be tested per the local gas company requirements or the following (whichever is stricter):

- Low Pressure (up to 14” wc) – Test to 10 psi for 24 hours.
- Elevated Pressure (up to 2 psi) – Test to 50 psi for 24 hours.
- Medium pressure (up to 60 psi) – Test to 100 psi for 24 hours.

4.10 Contractor shall notify TAB Agency in writing that the domestic water system has been flushed, cleaned and ready for sterilization or sanitizing. No chemicals are to be added to this system until all balancing has been completed for risk of contamination. The TAB firm is to properly notify all parties in writing when they have completed this portion of testing. If not properly coordinated, then the system will require additional sterilization and sanitizing at the Contractor’s expense. Refer to TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS Specification Section.

PART 5 – PITCH OF PIPING:

5.1 All piping systems shall be installed so as to drain to a low point. Certain minimum pitches shall be required for this drainage. For proper flow and/or for proper operation, the following pitches shall be required:

5.2 INTERIOR SOIL, WASTE AND VENT PIPING: ¼” per foot in direction of flow where possible but in no case less than 1/8" per foot.

5.3 SITE SANITARY LINES: Not less than one (1) % fall in direction of flow and no greater than indicated.

5.4 SITE STORM LINES: Not less than one (1) % grade in direction of flow.

5.5 ROOF LEADERS: 1/8” per foot where possible.

5.6 CONDENSATE DRAIN LINES FROM COOLING EQUIPMENT: Not less than ¼” per foot in direction of flow.

5.7 ALL OTHER LINES: Provide ample pitch to a low point to allow 100 percent drainage of the system.

PART 6 – EXTERIOR APPLICATIONS (SITE WORK):

6.1 SITE SANITARY SEWER: Refer to the Civil Plans and Specifications.

6.2 SITE STORM SEWER: Refer to the Civil Plans and Specifications.

6.3 SITE WATER: Refer to the Civil Plans and Specifications.

6.4 SITE FIRE PROTECTION: Refer to the Civil Plans and Specifications.

PART 7 – PLUMBING PIPING APPLICATIONS:

7.1 SOIL, WASTE AND VENT PIPING (BELOW SLAB):

7.1.1 Service weight cast iron hub and spigot piping with compression gasket joints. Service-weight cast-iron pipe and fittings shall be produced and labeled as ASTMA74 and C1563.

7.1.2 Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing Code (ASTM – D2665 & D1784). PVC pipe shall not be installed where waste water applications exceed 140 deg F.

7.1.3 Piping below slab shall be a minimum of 2” in size.

7.2 SOIL, WASTE AND VENT PIPING (ABOVE SLAB):

7.2.1 Service weight hubless cast iron pipe with manufacturer's approved bands. No-hub cast-iron and fittings shall be produced and labeled ASTM 888 or CISPI 301. No-hub couplings shall be produced and labeled as ASTM C1277, C1563, or CISPI 310.

7.2.2 Service weight cast iron hub and spigot piping with compression gasket joints. Service-weight cast-iron pipe and fittings shall be produced and labeled as ASTMA74 and C1563.

7.3 ROOF LEADERS AND STORM LINES (BELOW SLAB):

7.3.1 Service weight cast iron hub and spigot piping with compression gasket joints.

7.3.2 Schedule 40 PVC pipe with drainage pattern fittings and solvent cement joints made in accordance with the Plumbing Code (ASTM – D2665 & D1784).

7.4 ROOF LEADERS AND STORM LINES (ABOVE SLAB):

7.4.1 Service weight hubless cast iron pipe with manufacturer's approved bands.

7.4.2 Service weight cast iron hub and spigot piping with compression gasket joints.

7.5 DOMESTIC COLD, HOT AND RECIRCULATING HOT WATER PIPING (ABOVE SLAB):

7.5.1 Type "L" hard copper tubing with wrought copper fittings with lead free solder equivalent in performance to 95/5. (Maximum lead content of solder and flux is 2%).

7.6 DOMESTIC COLD, HOT AND RECIRCULATING HOT WATER PIPING (BELOW SLAB): Type "K" hard or soft copper tubing with wrought copper fittings and brazed joints. There shall be no joints beneath slabs.

7.7 NATURAL GAS PIPING – INTERIOR:

7.7.1 Schedule 40 black steel pipe with malleable iron threaded fittings for pipe sizes 2" and smaller.

7.7.2 Schedule 40 black steel pipe with wrought steel buttwelded fittings for pipe sizes 2½" and larger.

7.7.3 Where gas pressure is 2 psi or greater, piping shall be schedule 40 black steel pipe with wrought steel buttwelded fittings.

7.7.4 Paint all exterior piping as specified in Section IDENTIFICATIONS, TAGS, CHARTS, ETC.

7.8 FIRE PROTECTION: - Refer to Specification Section – FIRE PROTECTION.

PART 8 – HVAC PIPING APPLICATIONS

8.1 HVAC HYDRONIC PIPING:

8.1.1 System Types:
- Hot Water

8.1.2 2” and Smaller: Schedule 40 black steel pipe with screwed fittings or Type “L” hard copper tubing with wrought copper fittings and 95/5 solder.

8.2 REFRIGERANT PIPING: Type "L" copper tubing with forged or wrought copper fittings and silver soldered joints. Solder must have a minimum of 15% silver content.

8.3 AIR VENT DISCHARGE LINES: Type "L" soft copper; wrought copper fittings, 95/5 solder. Pipe to a suitable drainage location.

8.4 CONDENSATE DRAIN LINES: Type "M" copper tubing with sweat fittings and 95/5 solder.

PART 9 – ABOVE CEILING PIPING RELOCATION:

9.1 Include in this project, the relocation of the following piping systems:
- Offset 10, 1” domestic water pipes, with (4) elbows, insulated and 20 feet total length.
- Offset 10, 1-1/2” domestic pipes, with (4) elbows, insulated and 20 feet total length.
- Offset 10, 2” sanitary pipes, with (4) elbows and 20 feet total length.
- Offset 10, 4” sanitary pipes, with (4) elbows and 20 feet total length.
- Offset 10, 1-1/4” hydronic hot water pipes, with (4) elbows, insulated and 20 feet total length.
- Offset 10, 2” hydronic hot water pipes, with (4) elbows, insulated and 20 feet total length.

9.2 During Construction, the Contract Sum shall be increased OR decreased based on Contract unit prices for each of the above.

END OF PIPE, PIPE FITTING AND PIPE SUPPORT

SECTION 20 13 10 – PIPE FILLING, CLEANING, FLUSHING, PURGING AND CHEMICAL TREATMENT

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 Review the Specification Section – REQUIRED SHOP DRAWINGS, ETC., and provide all documentation called for therein.

1.3 Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall ensure a complete, 100% functional, tested, inspected, and approved systems. Claims for additional cost or change orders will immediately be rejected.

1.4 Chemicals, equipment, testing services, and chemical applications shall be supplied by a single water treatment company for undivided responsibility. The water treatment company shall be a recognized specialist, active in the field of commercial/industrial water treatment for at least 5 years. The water treatment company shall have regional water analysis laboratories, service departments, and full time representatives located within the area of the job site or facility.

1.5 Prior to any construction, the Contractor shall sample the existing closed loop chemicals and provide chemical treatment water quality analysis. Provide levels for all items noted in paragraph “Water Quality Minimum Performance Requirements for Closed Loops”. Provide a report to the Engineer.

1.6 Be advised the existing loop contains an anti-freeze mixture. Prior to any construction, the Contractor shall sample the existing closed loop and provide anti-freeze mixture data.

1.7 Furnish initial supply of the closed loop chemicals for each system. This contractor shall retest the systems after 3, 6, 9 and 12 months upon substantial completion to verify the proper dosage is in each system. Provide all closed loop chemicals and anti-freeze for the first year. The Contractor shall determine the appropriate chemical volumes for each system. Each system’s water shall be tested for proper chemical parameters, clarity, and biological activity. If needed, provide chemical addition, including anti-freeze. Provide any laboratory and technical assistance required to achieve a successful program.

1.8 As a condition of acceptance and project closeout, a summary of water quality and treatment shall be provided in writing to the Owner and/or Engineer after the water treatment services have been successfully completed. The closeout documentation shall include dates for warranty testing.

1.9 Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

1.10 WATER QUALITY MINIMUM PERFORMANCE REQUIREMENTS FOR CLOSED LOOPS:

- Closed hydronic systems shall maintain a pH value within 9 – 10.5 pH for iron and copper piping loops.

- Total Anaerobic Plate Count - Maintain a maximum value of 100 organisms/ml.
- Nitrate Reducers (Denitrifying Bacteria) - Maintain below a maximum value of 10,000 organisms/ml.
- Sulfate Reducers - Maintain below a maximum value of 200 organisms/ml.
- Iron Bacteria - Maintain below a maximum value of 100 organisms/ml.
- Slime Bacteria - Maintain below a maximum value of 1,000 organisms/ml.

PART 2 – CLEANING AND FLUSHING OF HYDRONIC PIPING:

2.1 This project consists of the following Hydronic Piping Loops:
- Hot Water

2.2 There are several precautions which must be observed during piping installation. This contractor is advised to read all of the manufacturer's instructions prior to commencing the installation. This cleaning and flushing of the systems must be accomplished.

2.3 All water circulating systems for the project shall be thoroughly cleaned before placing in operation to rid the system of dirt, piping compound, mill scale, oil and any and all other material foreign to the water. During construction, extreme care shall be exercised to prevent all dirt and other foreign matter from entering the pipe or other parts of the system. Pipe stored on the project shall have the open ends capped and equipment shall have all openings fully protected. Before erection, each piece of pipe, fitting or valve shall be visually examined, and all dirt removed.

2.4 After the piping is complete:

2.4.1 The Contractor shall first fill the piping loops and all runouts with clear water. The loop water shall be circulated for one hour with make-up water open and boiler drain open to accomplish initial flushing of the system.

2.4.2 After initial flushing, all strainers shall be cleaned, and the individual terminal devices and coils shall be connected permanently to the supply and return runouts conditions and then add trisodium phosphate in an aqueous solution to the system at the proportion of one pound per fifty gallons of water in the system.

2.4.3 After the system is filled with this solution, the loop shall be allowed to circulate for 24 hours.

2.4.4 The Chemical Treatment Contractor shall be given notice by the Contractor of scheduling this cleaning and, if the Engineer's representative deems it necessary, the operation shall be repeated.

2.4.5 After the system has been completely cleaned as specified herein, it shall be tested by litmus paper or other dependable method and shall be left on the slightly alkaline side.

2.4.6 If the system is found to be still on the acid side, the cleaning by use of Trisodium Phosphate shall be repeated.

2.4.7 After the cleaning including all strainers and flushing is complete, and approved by CMTA, the Contractor shall provide the proper water treatment for the system.

END OF PIPE FILLING, CLEANING, FLUSHING, PURGING AND CHEMICAL TREATMENT

SECTION 20 21 00 - VALVES

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 Each Contractor shall provide all valves required to control, maintain, and direct flow of all fluid systems indicated or specified. This shall include but may not be limited to all valves of all types including balancing valves, air vents, drain valves, check valves, special valves for special systems, etc., for all Mechanical Systems.

1.3 ACCEPTABLE MANUFACTURERS: Lunkenheimer, Powell, Nibco, Crane, Jenkins, T & S Brass, Walworth, Milwaukee, DeZurik, Consolidated Valve Industries, Inc., Bell & Gossett, Apollo.

1.4 The following type valves shall not be acceptable: Zinc, plastic, fiber or non-metallic.

1.5 Each type of valve shall be of one manufacturer, i.e., ball valves, one manufacturer, butterfly valves, one manufacturer, check valves, one manufacturer, etc.

1.6 All valves shall comply with current Federal, State and Local Codes. All valves shall be new and of first quality. All valves shall be designed and rated for the service to which they are applied. Zinc, plastic, fiber, or non-metallic valves shall not be acceptable.

1.7 Contractor shall provide colored tape on ceiling tile where valves are located above ceiling. Provide access panels where valves are located above hard ceiling.

PART 2 – DOMESTIC WATER APPLICATIONS:

2.1 GATE VALVE (2" AND UNDER): Use ball valves as specified.

2.2 GATE VALVE (2" AND UNDER): Gate valve shall have bronze body, union bonnet, non-rising stem solid wedge and handwheel. Gate valve shall be rated for 150 psi working pressure. Gate valve shall be Nibco T-136 for threaded ends and Nibco S-136 for solder ends.

2.3 GATE VALVE (2½" AND LARGER): Gate valve shall have bronze body, bonnet, and solid wedge. Gate valve shall be rising stem with bolted bonnet and solid wedge. Valve shall have rated for 150 psi working pressure. Gate valve shall be Nibco T-134 for threaded ends or Nibco S-134 for solder ends.

2.4 GLOBE VALVES (2" AND UNDER): Globe Valves shall have bronze body, bonnet, and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 150 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.

2.5 CHECK VALVE (2" AND UNDER): Check valve shall have bronze body, disc, and hinge. check valve shall be Y-pattern type, horizontal swing, renewable disc and rated for 150 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.

2.6 BALL VALVES (2½"-3"): Ball valve shall have bronze body, ball, and reinforced, watertight seat. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure. Ball valve shall be Nibco T-580 for threaded ends and Nibco S-580 for solder ends. Provide extended handles for all ball valves installed in an insulated system.

2.7 THREE PIECE BALL VALVE (2" AND UNDER): Ball valve shall have bronze body, ball and reinforced, water tight seat. Valve shall be three piece, swing-out, construction to facilitate inspection and repair. Valve shall be "full-port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 180 degrees F water temperature and 150 psi working pressure. Ball valve shall be Nibco T-595 for threaded ends and Nibco S-595 for solder ends.

2.8 BUTTERFLY VALVES (2-1/2" AND LARGER): Butterfly valve shall have ductile iron body with stainless steel disc. Valve to have extended neck to allow for insulation and be "lug" type configuration. Interior liner shall be made of EPDM. Lever handle shall be lock type with 10 position settings. Valve to be rated for 200 psi working and have positive shut-off equal to Nibco LD-2000

2.9 STRAINERS (2" AND UNDER): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.

2.10 STRAINERS (2½" AND LARGER): Watts 77F Series "Y" type strainer with semi-steel body and flanged ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with bolted cleanout and be rated for 200 psi working pressure.

2.11 PRESSURE REDUCING VALVES: Watts #U5B water pressure reading valve with bronze body, bolted bonnet, integral stainless steel strainer and outlet water pressure gauge. Internal disc, diaphragm and stainless steel seat shall all be removable. Valve shall be rated for inlet water pressures up to 300 psi. Water pressure reducing valves shall be provided for all equipment where water pressure exceeds the equipment manufacturer's ratings.

2.12 VACUUM BREAKERS: Watts #288A atmospheric type vacuum breaker with brass body. Vacuum breaker shall be rated for 210 degrees F and 125 psi working pressure and shall meet ASSE Standard 1001.

2.13 DOUBLE CHECK VALVE: Double check valve shall have bronze body construction and be provided with inlet strainer, two (2) gate valves for isolation and three (3) test ports. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. Assembly must meet requirements of AWWA Standard C506. For sizes 2" and less, provide Watts #900 (or equal) with threaded ends. For sizes 2½" and larger, provide Watts #709 (or equal) with flange ends.

2.14 REDUCED PRESSURE BACKFLOW PREVENTERS: Reduced pressure backflow preventers shall be provided with inlet strainer, two (2) gate valves/ball valves for isolation, three (3) test ports and air gap fitting. Assembly shall be rated for 110 degrees F water temperature and 175 psi water pressure. RPBP shall be UL listed and meet AWWA C511 standards. Watts #LF909 or equal by Wilkins or Conbraco. All valves 3" and less in size shall bronze body lead-free construction, over 3" in size shall have epoxy coated cast iron bodies. Assemblies 2" and under in size shall have threaded ends, over 2" in size shall have flange ends. Perform backflow preventer test and provide results with closeout documentation. All reduced pressure backflow preventers shall be mounted a maximum of 48" above the finished floor, unless noted otherwise.

2.15 BALANCING VALVE: Furnish and install balancing valves as indicated on the plans. The balancing valve shall be self-contained and fully automatic without additional piping or control mechanisms. Balancing valve shall be CircuitSolver as manufactured by ThermOmegaTech, Inc. or equal.

PART 3 – HVAC APPLICATIONS:

3.1 GATE VALVE (2" AND UNDER): Use ball valves as specified.

3.2 GATE VALVE (2" AND SMALLER): Gate valve shall have bronze body, union bonnet, non-rising stem solid wedge and handwheel. Gate valve shall be rated for 200 psi working pressure. Gate valve shall be Nibco T-136 for threaded ends and Nibco S-136 for solder ends.

3.3 GATE VALVE (2½" AND LARGER): Gate valve shall have cast iron body with cast iron bolted bonnet, non-rising stem, solid cast iron wedge and handwheel. Gate valve shall be rated for 200 psi working pressure. Gate valve shall be Nibco F-619 for flanged ends and Nibco T-619 for threaded ends. Threaded end valve allowed for sizes 3" or less only.

3.4 OS&Y GATE VALVES: OS&Y gate valve shall have cast iron body with cast iron bolted bonnet, bronze rising stem, solid cast iron wedge and handwheel. From viewing stem, valve position shall be capable of being determined. Valve shall be rated for 200 psi service. OS&Y gate valve shall be Nibco F-617-0 with flanged ends.

3.5 GLOBE VALVE (2" AND UNDER): Globe valve shall have bronze body, bonnet, and disc holder. Globe valve shall have union bonnet, integral seat, teflon or stainless steel renewable disc and be rated for 200 psi working pressure. Globe valve shall be Nibco T-235 for threaded ends or Nibco S-235 for solder ends.

3.6 GLOBE VALVES (2½" AND OVER): Globe valve shall have cast iron body, bolted bonnet, bronze disc, renewable seat and have outside screw and yoke. Handwheel to be cast iron. Globe vale to be rated for 200 psi working pressure. Globe valve shall be Nibco F-718 for flanged ends of Nibco T-718 for threaded ends. Threaded ends valve allowed for sizes 3" and less only.

3.7 CHECK VALVES (2" AND LESS): Check valve shall have bronze body, disc, and hinge. Check valve shall be Y-pattern type horizontal swing, renewable disc and rated for 200 psi working pressure. Check valve shall be Nibco T-413 for threaded ends or Nibco S-413 for solder ends.

3.8 CHECK VALVES (2½" AND LARGER): Check valve shall have cast iron body and cast iron bolted bonnet the disc and seat ring shall be bronze. Check valve shall be horizontal swing with renewable seat and disc. Valve shall be rated for 200 psi working pressure. Check valve shall be Nibco F-918 for flanged ends and Nibco T-918 for threaded ends. Threaded ends valve allowed for sizes 3" and less only. Victaulic 716/W716 are acceptable with grooved piping systems.

3.9 THREE PIECE BALL VALVES (2" AND UNDER): Ball valve shall have bronze body, ball, and reinforced, watertight seat. Valve shall be three piece, swing-out, construction to facilitate inspections and repair. Valve shall be "full port" type. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure. Ball valve shall be Nibco T-595 for threaded ends and Nibco S-595 for solder ends. Provide extended handles for all ball valves installed in a chilled water system or dual temperature hot/chilled water system.

3.10 BALL VALVES (2½"-3"): Ball valve shall have bronze body, ball, and reinforced, watertight seat. Valve handle shall only require quarter turn to go from full open to full close. The handle shall be removable with vinyl grip. Valve shall be rated for 250 degrees F water temperature and 200 psi working pressure. Ball valve shall be Nibco T-580 for threaded ends and Nibco S-580 for solder ends. Provide extended handles for all ball valves installed in chilled water piping systems.

3.11 BALL VALVE (2-1/2" TO 6"): Ball valve shall have a cast iron body, with Teflon fused solid ball, blow-out proof stainless steel stem, and reinforced Teflon seats. Valve shall be "full port" type and the handle shall only require a quarter turn to go from full open to full close. The handle shall be removable with a vinyl grip. Valve shall be rated for a 200 psi working pressure and 350°F temperature. Ball valve shall be American Model 4000 or approved equal. Valves installed in chilled or dual temperature hydronic systems shall be insulated up to the handle to eliminate condensation. Extend the handle as required.

3.12 STRAINERS (2" AND UNDER): Watts 77S Series "Y" type strainer with cast iron body and threaded ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with cleanout plug and be rated for 200 psi working pressure.

3.13 STRAINERS (2½" AND LARGER): Watts 77F Series "Y" type strainer with semi-steel body and flanged ends. Screen shall be 20 mesh stainless steel. Strainer shall be provided with bolted cleanout and be rated for 200 psi working pressure.

3.14 BALANCING VALVE (4" AND LESS): Balancing valve shall have DZR brass body. Valve shall be Y-pattern, globe style with multi-turn handle. Valves to have differential pressure readout ports across valve seat area with integral check valves. Valve shall be equipped with memory stop. Valves to have threaded ends for sizes 2" and less, and flanged or grooved ends for larger sizes. Valve to be provided with performed molded insulation casing. Design working pressure and temperature to be 200 psi at 250 degrees F. Balancing valve shall be similar to Victaulic TA Series 78KH. Quarter-turn type valve is not acceptable. Contractor may provide pre-packaged hydronic coil kits in accordance with project detail components. Provide with balancing valves, one (1) water gpm readout kit to be turned over to Owner which shall include a differential pressure meter with full scale overrange protection, hoses, readout probes, filters, carry and calculator. Readout kit shall be of the same manufacturer as the balancing valves.

3.15 AUTOMATIC AIR VENT: Bell & Gossett Model 107A high capacity float actuated automatic air vent with cast iron body and bonnet. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature. Pipe discharge to nearest floor drain unless noted otherwise.

3.16 MANUAL AIR VENT: Bell & Gossett Model 78 manual air vent with cast brass body and built-in check valve. Vent to be rated for 150 psi working pressure and 240 degrees F working temperature. Install with 12" length of 1/4" soft copper discharge piping unless noted otherwise.

PART 4 – NATURAL GAS APPLICATIONS:

4.1 GAS BALL VALVE (2" AND LESS): Nibco TFP600N gas ball valve. Valve shall forge two-piece brass, CSA/CGA CR 91-002 certified, 5 psig rating, lever handle, full port ball valve, lubricated shaft, PTFE seats, blowout proof stem and threaded ends.

4.2 GAS LUBRICATED PLUG VALVE, (2½" AND GREATER): Homestead lubricated industrial plug valve, Model 611/612, 100% round port, leak-proof, spring loaded ball and lubricant sealed check valve. Provide with threaded ends and lever handle.

END OF VALVES

SECTION 20 22 00 - INSULATION - MECHANICAL

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 Work under this section shall include all labor, equipment, accessories, materials, and services required to furnish and install all insulation, fittings and finishes for all mechanical systems specified herein and/or as indicated.

1.3 Application of insulation materials shall be performed in accordance with manufacturer's written recommendations. Where thickness of insulation is not specified, use applicable thickness recommended by manufacturer for specific use.

1.4 Insulation thicknesses shall comply with the latest version of ASHRAE 90.1 and IECC at a minimum.

1.5 All insulation materials shall be installed per the latest edition of the National Commercial and Industrial Insulation Standards.

1.6 Insulation shall be installed by a company regularly engaged in the application of insulation and any work deemed unacceptable by the Engineer shall be removed and properly installed at the expense of the Contractor.

1.7 The Contractor shall photograph any installations prior to concealment. This includes duct risers in chases and at rooftop equipment.

PART 2 – ACCEPTABLE MANUFACTURERS:

2.1 Johns Manville, Knauf, Owens-Corning.

PART 3 – FIRE RATINGS AND STANDARDS:

3.1 Insulations, jackets, facings, adhesives, mastics, tapes, fitting materials, etc. shall have composite fire and smoke hazard ratings as tested by ASTM E-84, NFPA 255 and UL 723 procedures not exceeding Flame Spread 25, Smoke Developed 50 and Fuel Contributed 50.

3.2 All products and their packaging shall bear a label indicating above requirements are not exceeded.

3.3 Fiber glass duct wrap shall meet the requirements of Scientific Certification Systems Certification or Greenguard Validation of Formaldehyde Free.

3.4 Fiber glass mechanical board shall meet the requirement of the Greenguard Standards for Low-Emitting Products.

3.5 Fiber glass pipe insulation shall meet the requirement of the Greenguard Gold level standard.

PART 4 – GENERAL APPLICATION REQUIREMENTS:

4.1 “Concealed", where used herein, shall mean hidden from sight as in trenches, chases, furred spaces, pipe shafts, or above hung finished ceilings. "Exposed" shall mean that piping or equipment is not "concealed" as defined above. Piping and equipment in service tunnels, mechanical equipment rooms, storage areas, or unfinished rooms is to be considered "exposed".

4.2 Insulation shall be applied on clean, dry surfaces in a neat and workmanlike manner reflecting the best current practices in the trade. Insulation shall not be applied to piping, ductwork or equipment until tested, inspected and released for insulation.

4.3 Where more than one thickness of insulation is required, joints (both longitudinal and transverse) shall be staggered.

4.4 All insulation shall be continuous through walls, ceiling openings and sleeves. However, insulation shall be broken through fire walls. All covered pipe and ductwork is to be located a sufficient distance from walls, other pipe, ductwork and other obstacles to permit the application of the full thickness of insulation specified. If necessary, extra fittings and pipe are to be used. No noticeable deformation of insulation or discontinuity of vapor seal, where required, will be accepted. Coordinate work with plumbers, pipe fitters, etc. to assure hanger locations agree with location of insulation inserts.

4.5 Existing and/or new insulation removed and/or damaged during course of construction shall be repaired or replaced by the Contractor at their expense.

4.6 Vapor barrier jackets shall be applied with a continuous unbroken vapor seal. Do not use staples through the jacket. NO EXCEPTIONS!

4.7 All insulation shall be installed with joints butted firmly together.

4.8 The Contractor shall ensure that all insulation (piping, ductwork, equipment, etc.) is completely continuous along all conduits, equipment, connection routes, etc. carrying cold fluids (air, water, other) and that condensation can, in no way, collect in or on the insulation, equipment, conduits, etc. Any such occurrence of condensation collection and/or damage therefrom shall be repaired solely at the expense of the Contractor.

4.9 Unless otherwise specified or allowed, closed cell type insulation shall not be acceptable.

4.10 Piping and ductwork supports, including hangers, straps, uni-strut and all-thread rods, for insulated piping and ductwork shall be insulated and vapor sealed a minimum of 18” minimum beyond the piping and ductwork to prevent condensing. Coordinate with Sheetmetal Contractor.

PART 5 – PIPING SYSTEMS:

5.1 Seal insulation and jacket at all points where insulation terminates at unions, flanges, valves, and equipment. This applies to hot water lines only as cold water lines require continuous insulation and vapor barrier.

5.2 Pipe insulation shall extend around valve bodies to above drain pans in hydronic equipment over pumps, etc. to ensure no condensation drip or collection.

5.3 Valves, flanges, and unions shall only be insulated when installed on cold fluid piping whose surface temperature will be at or below the dew point temperature of the ambient air.

5.4 Insulation shall not extend through fire and smoke walls. Pack sleeve at fire and smoke wall with approved fire retardant packing similar to mineral wool and seal with approved sealant.

5.5 Metal insulation shields and inserts are required at all pipe hangers where the piping is insulated. Metal shields shall be constructed of galvanized steel, formed to a 180 degree arc. Insulation shields shall be the following size:

Pipe Size	Shield Gauge	Shield Length
2” and less	20	12”
2 ½”- 4”	18	12”
5”- 10”	16	18”
Over 10”	14	24”

5.6 Insulated pipes 2” in diameter and larger shall be additionally supported with wood inserts of sufficient compressive strength to carry the weight of the pipe and fluid. Inserts shall extend beyond extend beyond the hanger and shall be at least 6” in length.

5.7 Provide premolded PVC insulated fitting covers on all pipe fittings, flanges, valves, and pipe terminations. Fittings shall be insulated by applying the proper factory precut insulation insert to the pipe fitting. The ends of the insulation insert shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe insulation tufted and tucked in, fully insulating the pipe fitting. The proper thickness of insulation must be applied to keep the jacket temperature less than 150°F. An approved vapor retarder mastic compatible with the PVC shall be applied around the edges of the adjoining pipe insulation and on the fitting cover throat overlap seam. The PVC fitting cover shall then be applied and secured with pressure sensitive tape along the circumferential edges. The tape shall extend over the adjacent pipe insulation and have an overlap on itself at least 2" on the downward side. On fittings where the operating temperature is below 50°F, two or more layers of the insulation inserts shall be applied with the first layer being secured with a few wrappings of fiber glass yarn to eliminate voids. One additional insert shall be used for each additional 1" of pipe insulation above 1-1/2". All joints shall be fully sealed.

5.8 PIPE INSULATION MATERIAL: Insulation shall be Knauf "Earthwool 1000° Pipe Insulation ASJ+/SSL+" or approved equivalent fiberglass pipe insulation with an all service jacket. The insulation shall be a heavy density, pipe insulation with a K factor not exceeding 0.27 Btu per inch/h.ft² °F at 75°F mean temperature. The insulation shall be wrapped with a vapor barrier jacket. The jacket shall have an inside foil surface with self sealing lap and a water vapor permeability of 0.02 perm/inch. All circumferential joints shall be vapor sealed with butt strips. All insulation shall be installed in strict accordance with the manufacturer’s recommendations. The following pipes shall be insulated with the minimum thickness of insulation as noted.

5.8.1 Domestic Cold Water: 1" thick insulation
5.8.2 HVAC Fill Lines: 1” thick insulation
5.8.3 Exterior HVAC Fill Lines: 1” thick insulation with heat trace jacketing
5.8.4 Roof Drain Piping: 1” thick insulation (Horizontal piping for primary & overflow systems)

5.8.5 Domestic Hot Water & Return Lines:
- Piping 1-1/4" and less: 1" thick insulation
- Piping 1-1/2"" and greater: 2” thick insulation

5.8.6 Hydronic Hot Water:
- Piping 1-1/4" and less 2" thick insulation

5.8.7 Refrigerant Lines:
- Piping 1-1/4" and less: 1/2” thick insulation
- Piping 1-1/2" and greater: 1" thick insulation
- All exterior piping: 1-1/2” thick with jacketing

5.8.8 Condensate Drain Lines: 1/2" thick.

5.9 EXPOSED, INTERIOR PIPING JACKETS: All insulated piping installed in the above areas shall have a 6 oz. canvas jacket with fire retardant lagging apply to the insulation specified for the piping. Refer to floor and ceiling plans for locations of all exposed piping. This applies to all exposed piping.

PART 6 – DUCTWORK SYSTEMS:

6.1 Duct sizes indicated are the net free area inside clear dimensions; where ducts are internally lined, overall dimensions shall be increased accordingly.

6.2 Duct insulation shall extend completely to all registers, grilles, diffusers, and louver outlets, etc., to ensure no condensation drip or collection.

6.3 EXTERNAL INSULATION FOR SUPPLY, OUTSIDE AIR DUCTWORK: Knauf "Friendly Feel" faced, Duct Wrap, 0.75 PCF density, 2.2" thick or approved equivalent. Wrap shall be factory laminated to a reinforced foil kraft vapor barrier facing (FRK) with a 2" stapling flange at one edge. The installed R value shall be a minimum of 6.0. Flame spread 25, smoke developed 50, vapor barrier performance 0.02 perms per inch.

6.4 EXPOSED EXTERNAL INSULATION SUPPLY AND OUTSIDE AIR DUCTWORK: Refer to floor and ceiling plans for locations of exposed ductwork. This applies to all exposed ductwork if not above ceiling. Knauf "Insulation Board" or approved equivalent industrial insulation. Use 1½" rigid fiberglass industrial board with foil scrim kraft vapor barrier facing, 6.0 PCF density, K=0.22 Btu in/hr.ft² °F @ 75°F. Use 1/2" thick, 1.6 PCF insulation board for round ducts. The installed R-value shall be a minimum of 6.0. Flame spread 25, smoke developed 50, vapor barrier performance 0.02 perms per inch. Provide 6oz. canvas jacket with fire retardant lagging and provide a metal corner bead at all duct corners (on the exterior of the insulation) for protection. The corner bead shall be taped in place with foil scrim tape.

PART 7 – MECHANICAL EQUIPMENT:

7.1 ROOF DRAIN SUMPS: Knauf "Pipe and Tank Insulation" or approved equivalent rigid board insulation with exterior vapor barrier jacket formed to bottom of sump basin. Insulation shall have a K factor of 0.26 at 100°F. mean temperature. Insulation shall be 1" thick. Insulation shall be formed to roof drain sump. Vapor barrier shall remain continuous.

END OF INSULATION - MECHANICAL

SECTION 20 24 00 - IDENTIFICATIONS, TAGS, CHARTS, ETC.

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

PART 2 – TAGS AND CHARTS:

2.1 Provide and install on each valve 1” in size or greater for all mechanical systems a 1.5" diameter circular bronze or baked phenolic tag fitted to each valve so that it cannot be removed. Each tag shall be embossed consecutively with sequential number identifiers. Number identifiers shall be determined by the Contractor sequentially.

2.2 Provide typewritten valve charts indicating each valve identifier, the valves service, normal position, and its location. Also furnish one electronic copy on CD in “*.xls” format. One (1) copy of this chart shall be mounted in suitable frame(s) with clear plastic covers in a conspicuous location in each of the major mechanical rooms. Repeat only main valves which are to be operated in conjunction with operations of more than single mechanical room.

2.3 All emergency shutoff valves shall be identified with a permanent engraved tag hung from the valve with 1-inch high lettering. Emergency shutoff valves shall be identified as any valve whose closure could create an emergency condition in the facility (i.e. natural gas, water, domestic hot water, main HVAC valves, etc.).

2.4 Label all control panels and disconnect switches with service and equipment served.

PART 3 – PIPING AND DUCTWORK IDENTIFICATION:

3.1 All piping and ductwork installed shall be identified according to the charts hereinafter specified. Provide stenciled markers and arrows indicating direction of flow on all piping and ductwork installed under this contract. Markers and arrows shall be painted on the piping and ductwork using machine cut stencils. All letters shall be sprayed using fast drying lacquer paint. All markers and arrows shall be properly oriented so that descriptive name may be easily read from the floor. Piping and ductwork shall be identified on twelve (12) foot centers. All piping and ductwork shall be minimally identified once above all room ceilings and where it passes thru walls or floors. At the Contractor's option, Setmark or equivalent manufactured marking system may be substituted for field marking.

3.2 The following table describes the size of the color field and size of the identification letters which shall be used for pipes of different outside pipe diameters.

Outside Diameter	Label Length	Letter Size
¾” – 1 ¼”	8”	½”
1 ½” – 2”	8”	¾”
2 ½” – 6”	12”	1 ¼”
8” – 10”	24”	2 ½”
Over 10”	24”	3 ½”

3.3 The following chart describes the pipe service and label identification which shall be used for various pipes.

PIPE	ABBREVIATION
Refrigeration	R.S / R.L.
Hot Water Supply/Return	H.W.S. / H.W.R.
Domestic Cold Water	D.C.W.
Domestic Hot Water	D.H.W.
Recirculated Hot Water	R.H.W.
Non-Potable Water	NON-POTABLE WATER** (**yellow letters, every 2'-0")
Natural Gas	NG
Fire Protection	SPRINKLER
Sanitary Sewer Piping	SAN
Sanitary Vent Piping	VENT
Storm Sewer Piping	STORM

PART 4 – NATURAL GAS PIPING IDENTIFICATION:

4.1 All natural gas piping within mechanical rooms shall be painted safety orange. Natural gas valves shall be painted red. Piping shall be prepped as required and piping shall be painted with at least two coats of paint or more if required to properly cover the piping. Piping in the kitchen shall be painted black. Exterior gas piping shall be painted to match the building with color as directed by the Architect/Owner.

4.2 In addition, natural gas piping and meter loop piping shall be painted color as selected by Architect. Do not paint over gauges, name plates or vent/regulator openings.

PART 5 – EQUIPMENT IDENTIFICATION:

5.1 Unless otherwise specified, all equipment shall be identified. The titles shall be short and concise, and abbreviations may be used as long as the meaning is clear. In finished rooms and mechanical rooms, equipment shall be identified neatly and conspicuously with engraved black lamacoid plates (or equivalent) with 1" high white letters on the front of each piece of equipment.

5.2 All mechanical equipment and associated starters/disconnects shall have the electrical panel number and circuit number identified on a lamacoid plate. Coordinate with the Electrical Contractor.

PART 6 – DUCTWORK IDENTIFICATION:

6.1 All ductwork shall be identified as to the service of the duct and direction of flow. Include equipment designator on SA & RA ductwork. The letters shall be at least two inches high and the flow arrow shall be at least six inches long. The letters and flow arrow shall be made by precut stencils and black oil base paint with aerosol can. Concealed ducts also need to be identified.

6.2

DUCTWORK	ABBREVIATION
Supply Air Ductwork	SA + Equipment Identifier
Return Air Ductwork	RA + Equipment Identifier
Exhaust Air Ductwork	EA + Equipment Identifier
Outside Air Ductwork	OA + Equipment Identifier
Kitchen Exhaust Air Ductwork	KEA + Equipment Identifier

PART 7 – ACCESS THROUGH LAY-IN CEILINGS:

7.1 Mark each lay-in ceiling panel which is nearest access to equipment, valves, dampers, filters, duct heaters, etc., with colored tape labels located on the ceiling grid.

END OF IDENTIFICATIONS, TAGS, CHARTS, ETC.

SECTION 20 25 00 - HANGERS, CLAMPS, ATTACHMENTS, ETC.

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 Each Contractor's attention is also directed to Specification Section PIPE, PIPE FITTINGS AND SUPPORT.

1.3 This section includes, but is not limited to, furnishing, and installing supports, anchors, and accessories for piping, ductwork, equipment, etc. Furnishing and installing shall be by each trade for the completion of their work as directed in this Section.

PART 2 – MATERIALS AND EQUIPMENT:

2.1 HANGERS, CLAMPS, ATTACHMENTS SCHEDULE:

- ACCEPTABLE MANUFACTURERS: Grinnell, Elcen, Fee & Mason.
- All hangers, clamps and attachments shall be manufactured products.
- Pipe Rings (2” pipe and smaller) – adjustable swivel split ring or split pipe ring.
- Pipe Clevis (2.5” pipe and larger) – adjustable wrought clevis type.
- Pipe Clevis (All pipe sizes) – steel clevis for insulated pipe.
- Riser Clamps (All pipe sizes) – extension pipe or riser clamp.
- Beam Clamps (All pipe sizes) – malleable beam clamp with extension piece.
- Brackets (All pipe sizes) – medium weight steel brackets.
- Concrete Inserts (All pipe sizes) – wrought or wedge type inserts.
- Concrete Fasteners (All pipe sizes) – self-drilling concrete inserts.
- Rod Attachments (All pipe sizes) – extension piece, rod coupling, forged steel turnbuckle
- U-bolts (All pipe sizes) – standard u-bolt.
- Welded Pipe Saddles (All pipe sizes) – pipe covering protection saddle sized for thickness of insulation.
- Pipe Roll (All pipe sizes) – adjustable swivel pipe roll.
- Protection Saddle (All pipe sizes) – 180 degree coverage, sheet metal pipe protection saddle.
- Hanger Rods (All pipe sizes) – Steel, diameter of hanger threading.
- Concrete Channel Inserts (All pipe sizes) – continuous heavy duty slot inserts unistrut.
- Adjustable Spot Inserts (All pipe sizes) – continuous heavy duty spot insert unistrut.
- Miscellaneous steel such as steel angles, rods, bars, channels, etc used in framing for supports, fabricated brackets, anchors, etc. shall confirm to ASTM-A-7.

2.2 HANGER RODS

2.2.1 Hanger rods or single rod hangers shall conform to the following:

PIPE SIZE	HANGER ROD DIAMETER STEEL PIPE	HANGER ROD DIAMETER COPPER, PLASTIC, HDPE
2” and smaller	3/8”	3/8”
2-1/2” through 3-5/8”	1/2”	1/2”
4” and 5”	5/8”	½”
6”	3/4”	5/8”

8” through 12”	7/8”	3/4”
14”	1’	7/8”

2.3 Rods for double rod hangers may be reduced on size. Minimum rod diameter is 3/8 inches.

2.4 Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

PART 3 – INSTALLATION:

3.1 Supporting and hanging shall be done so that excessive load will not be placed on any one hanger to allow for proper pitch and expansion of piping.

3.2 Hangers and supports shall be placed as near as possible to joints, turns, and branches.

3.3 For concrete construction, utilize adjustable concrete inserts for fasteners. Expansion anchors and power driven devices may be used when approved in writing by the Architect/Engineer.

3.4 Utilize beam clamps for fastening to steel joists and beams. Expansion anchors in masonry construction. Do not support piping or ductwork from bridging or metal decking.

3.5 When piping is routed in joists, piping shall be top mounted on trapeze type hangers with each pipe individually clamped to trapeze hanger. Do not support piping or ductwork from bridging angles.

3.6 Trapeze hangers are not allowed, unless specifically approved by the Engineer.

3.7 Install all miscellaneous steel other than designed building structural members as required to provide means of securing hangers, supports, etc., where piping does not pass directly below or cross structural elements.

3.8 Piping shall not be supported by the equipment to which it is connected. Support all piping to remove any load or stress from the equipment.

3.9 Where piping, etc., is routed vertically, approved riser clamps, brackets or other means shall be utilized at approximately 10'-0" center to center minimum. An approved adjustable base stand or fitting on concrete support base shall be utilized at the base of the vertical run.

3.10 Where piping is routed along walls, knee braced angle frames, etc. pipe brackets with saddles, clamps, and rollers mounted on structural brackets fastened to walls or columns shall be used.

3.11 Support all ceiling hung equipment with approved vibration isolators.

3.12 Where copper tubing is specified, hangers shall be of copper clad type when piping is uninsulated.

3.13 Uninsulated piping hung from above shall be supported with ring and clevis type pipe hangers. Uninsulated piping mounted on trapeze (when allowed) and wall bracket type support shall be held in place with U-bolts. U-bolts shall allow for axial movement in the piping.

3.14 All insulated piping shall be supported with clevis type and pipe roll hangers. Hangers shall be sized to allow the pipe insulation to pass through the hangers. Install insulation protection saddles at all hanger locations. Welded pipe saddles shall be installed at all hangers on piping 5" and larger. The pipe saddles shall be sized for the thickness of insulation used. Hangers shall fit snugly around outside of insulation saddles.

3.15 Under no conditions will perforated band iron or steel wire driven hangers be permitted.

3.16 Support steel and copper piping at a minimum of eight (8) foot intervals for piping 3" and smaller and ten (10) foot intervals for larger piping. Provide additional support at end of the branches and change of direction.

3.17 Support plastic pipe at intervals not to exceed four (4) feet and at the end of the branches and at the change of direction and shall be installed as to permit freedom of movement. Vertical piping shall be supported at their bases and all upward movement shall not be restricted. Hangers shall be at least one (1) inch wide and shall not compress, distort, cut or abrade the piping to allow free movement at all times.

3.18 Where fireproofing is dislodged/damaged from the building structure due to Contractor's installation of hangers, clamps, etc., it shall be the Contractor's responsibility to repair all dislodged/damaged fireproofing to original fireproofing rating. This shall also include all work performed by their Contractors sub-contractors.

3.19 Ensure that all bolts and nuts are tightened.

END OF HANGERS, CLAMPS, ATTACHMENTS, ETC.

SECTION 20 31 00 - TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Engineer, or authorized representative, shall be notified by the Contractor twenty-four (24) hours in advance of any tests called for in these Specifications or required by others.

1.3 Only after written approval, signed by the Engineer, shall the Contractor apply insulation or paint or allow the work to be furred in. This written approval, however, does not relieve the Contractor of the responsibilities for any failure during the guarantee period. The expense of all tests shall be borne by the Contractor, along with all temporary equipment, materials, gauges, etc. required for tests.

1.4 Contractor shall notify TAB Agency in writing that the domestic water system has been flushed, cleaned and ready for sterilization or sanitizing. No chemicals are to be added to this system until all balancing has been completed risk of contamination. The TAB firm is to properly notify all parties in writing when they have completed this portion of testing. If not properly coordinated, then the system will require additional sterilization and sanitizing at the Contractor’s expense. Refer to PIPE, PIPE FITTINGS AND PIPE SUPPORT Specification Section.

PART 2 - HEATING, VENTILATING AND AIR CONDITIONING TESTING:

2.1 The test and balance of this system shall be by a Contractor who employs only the services of a certified AABC or independent NEBB firm whose sole business is to perform test and balance services.

2.2 The test and balance contractor shall bid directly to the Mechanical Contractor or Construction Manager or Owner.

2.3 Mechanical Contractor shall provide all start-up documents to Test and Balance Contractor prior to any test and balance services.

2.4 The Mechanical Contractor shall test all piping before being insulated or concealed in any manner. Where leaks or defects develop, required corrections shall be made and tests repeated until systems are proven satisfactory. Water piping systems shall be subjected to a hydrostatic test as specified and shall be proven tight after a twenty-four (24) hour test.

2.5 All motors, bearings, etc. shall be checked and lubricated as required during start-up procedures. All automatic, pressure regulating, and control valves shall be adjusted. Excessive noise or vibration shall be eliminated.

2.6 System balancing, where required, shall be performed only by persons skilled in this work. The system shall be balanced as often as necessary to obtain desired system operation and results.

2.7 All fan belts shall be adjusted for proper operation of fans.

2.8 Testing shall occur after completion of the ceiling systems installation.

2.9 All deficiencies observed by the Test and Balance Contractor shall be reported immediately to the Engineer and Mechanical Contractor.

2.10 Refer to Specification Section – CONTROLS – DIRECT DIGITAL for additional requirements.

2.11 Refer to Specification Section – GENERAL PROVISIONS – MECHANICAL for startup requirements.

2.12 PRIOR TO DEMOLITION: Provide pre-construction test services information for the following areas. Information required is existing supply, return and exhaust air flow rates and static pressure profiles.

- Existing and new office areas.
- Existing kitchen.
- Existing cafeteria.

2.13 Provide a preliminary test report to the Engineer immediately after the system is air balanced, or any initial phases are balanced. This report may be handwritten. Any systems that are not found to operate within the design tolerances by the Test and Balance Contractor shall immediately be reported to the Engineer via telephone call to attempt to determine a resolution while the Test and Balance Contractor is still on site. Additional compensation will not be accepted for additional trips.

2.14 Anticipate visiting the site again after the Engineer has reviewed the report. The Engineer may request up to two (2) additional site visits for onsite troubleshooting where additional measurements may be required.

2.15 For the purpose of placing the Heating, Ventilating and Air Conditioning systems in operation according to design conditions and certifying same, final testing and balancing shall be performed in complete accordance with AABC Standards for Total System Balance, 7th edition for air and hydronic systems as published by the Associated Air Balance Council.

2.16 THE FOLLOWING SYSTEMS SHALL BE TESTED AND BALANCED:

- The supply, return, and outside air duct systems associated with all mechanical equipment. Provide static pressure profiles thru each system. Static pressure profiles shall include all sections from the return duct inlet and supply duct outlet of the units. Show accurate representation of return, relief, outdoor and economizer damper locations. Balance minimum outside air at value indicated.
- Balance all supply and return air grilles to within 10% of design air flow rate.
- Balance all exhaust air fans and record inlet static pressure.
- The water flow to all 2-pipe coils.

2.17 Balance all units rated for 2,000 cfm unit such that the total air volume delivered does not exceed 2,000 cfm, otherwise the Contractor shall furnish and install a code compliant duct smoke detection system integrated into the building's system.

2.18 Balance the water flow rate of each domestic hot water recirculating pump. Set the flow rate for each balancing valve in the recirculating hot water system. If flow rates are not indicated, contact the engineer for each balance valve GPM.

2.19 Instruments used for testing and balancing of air and hydronic systems shall have been calibrated within a period of six months prior to balancing. All final test analysis reports shall include a letter of certification listing instrumentation used and last date of calibration.

2.20 Test and Balance agency shall provide sizing of fan or motor sheaves required for proper balance. The Mechanical Contractor shall purchase and install all sheaves and belts as required. This includes new and existing equipment.

2.21 Three (3) copies of the complete test reports shall be submitted to the Consulting Engineer prior to final acceptance of the project. Preliminary test reports shall be submitted when requested.

2.22 The Contractor shall provide and coordinate work to provide sufficient time before final completion date so that tests and balancing can be accomplished and provide immediate labor and tools to make corrections when required without undue delay.

2.23 The Contractor shall put all heating, ventilating and air conditioning systems and equipment and rangehood system into full operation and shall continue the operation of same during each working day of testing and balancing.

2.24 The Test and Balance Contractor shall be present during the Engineer's final inspection of the building, or a separate project review date. The Engineer may request confirmation of the air balance report by asking for new measurements to be taken at that time. Any information in the test and balance report may be asked to be reconfirmed.

END OF TESTING, BALANCING, LUBRICATION, ETC.

SECTION 21 01 00 - FIRE PROTECTION SYSTEM

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 No Contractor, other than those regularly engaged in the installation of approved and franchised automatic sprinkler systems will be considered or approved for the work under this Specification Section. The Contractor shall have not less than five (5) years experience in the fabrication and erection of fire protection systems as specified. The Contractor shall have completed five (5) installations similar and equivalent in scope to the systems specified.

1.3 Before submitting bid, examine the Contract Documents, visit the site (if necessary) and become acquainted with all conditions that may, in any way whatsoever, affect the execution of this work. The Contractor shall take their own measurements and be responsible for exact size and location of all openings required for installation of this work. Figured dimensions where indicated are reasonably accurate and should govern in setting out work. Detailed method of installation is not indicated. Where variations exist between described work and approved practice, the Engineer shall be consulted for directive.

1.4 It is the intent of the Plans and Specifications to provide a general layout only and locate major equipment, components, piping, etc. Variations in head locations, pipe routing, etc., shall be anticipated by the Contractor and shall be coordinated with all other trades and indicated on the drawings and descriptive literature called for hereinafter. It shall be the express responsibility of the Contractor to provide all required design, materials and equipment and perform all work required to install a complete and approved installation.

1.5 All materials and methods shall be in accordance with applicable codes, regulations and/or ordinances and meet approval of local inspection authority and the State Fire Marshal. Also, all work shall comply with the latest editions of the National Board of Fire Underwriters, National Fire Protection Association, OHSA Regulations, the International Building Code, the Life Safety Code, International Mechanical Code, and governing building codes. All materials and equipment installed as a part of this work shall be listed by the Underwriters Laboratories, Inc. as approved for fire protection installations.

1.6 Where flow and pressure data are available, they are indicated on the project drawings. The Contractor shall independently verify all such information and notify the Engineer of any discrepancies discovered prior to beginning the work. Where no flow information is indicated on the project drawings, the Contractor shall obtain the data and indicate it on the shop drawing submittal. All flow information obtained shall be less than six (6) months old. Piping systems shall be hydraulically sized based on the most conservative flow information obtained. No adjustments in the contract amount will be allowed for failure of the Contractor to obtain adequate flow information.

1.7 All sprinkler piping shall be concealed above ceilings. Contractor shall be responsible for modifying the elevation of the existing sprinkler piping as necessary to conceal piping above the ceiling. Coordinate all ceiling related work with the architectural reflected ceiling plans. This includes but is not limited to the following: ceiling height changes, soffits, headers, lights, diffusers, grilles, speakers, cameras, fire alarm devices, etc. Refer to the architectural, electrical, and mechanical drawings for additional information.

1.8 The Owner's local insuring agency may review plans prepared and submitted by the Contractor but shall have no authority to make changes once work has begun. Coordinate with the Owner prior to construction.

1.9 All work performed under this section shall be accomplished in close harmony with all other trades. All work not so coordinated shall be removed and reinstalled at the expense of the Contractor.

1.10 Unless otherwise indicated, all materials shall be new and of the best grade and quality for type specified. Materials shall comply with the "Buy American Act".

1.11 Where piping is not indicated on the plans, but is obviously or apparently required, contact Engineer prior to submission of the bid.

1.12 All piping shall be capped or plugged during erection as required to keep clean and debris moisture free.

1.13 All piping shall be installed straight and true, parallel, or perpendicular to the building construction. Piping shall be installed to allow for expansion without damage to the building finishes, structure, pipe, equipment, etc., use offsets, U-bends or expansion joints as required. No mitered joints or field fabricated pipe bends shall be accepted. Pipe shall clear all windows, doors, louvers, and other building openings.

1.14 All pipes shall be supported in a neat and workmanlike manner and wherever possible, parallel runs of horizontal piping shall be grouped together on hangers. Vertical risers shall be supported as each floor line with approved steel pipe riser clamps. Spacing of pipe supports shall not exceed eight (8) foot intervals for pipes 3" and smaller and ten (10) foot intervals on all other piping. Small vertical pipes (1" and less) shall be bracketed to walls, structure members, etc. at four (4) foot intervals so as to prevent vibration or damage by occupants.

1.15 The use of wire or perforated metal to support pipes will not be permitted. Hanging pipes from other pipes shall not be permitted.

1.16 Support piping with standard pipe hangers with C-clamp connection to main structural members, use angle steel cross pieces between main structural members where required to provide rigid support.

1.17 Where piping rests directly on a hanger, clip, bracket, or other means of support, the xxx element shall be of the same material as the pipe, (e.g., copper to copper, ferrous to ferrous, etc.) or shall be electrically isolated one from the other to prevent pipe damage by electrolysis. Pay particular attention and do not allow copper pipe on ferrous structural members, equipment, etc. without electrolytic isolation. This includes temporary support require Construction.

1.18 In general, piping shall be installed concealed except in mechanical rooms, etc. unless otherwise indicated, and shall be installed underground or beneath concrete slabs only where indicated. All lines at ceiling shall be held as high as possible and shall run to avoid conflicts with other trades, and to facilitate the Owner's use and maintenance. Location of pipe in interior partitions shall be carefully coordinated with whoever will construct the partitions after the piping is in place. Where exposed risers occur, they shall be kept as close to walls as possible.

1.19 Pipe shall be cut accurately to measurements established at the building by the Contractor and worked into place without springing or forcing. All pipes shall be reamed to full pipe diameter before joining and before assembling. All lengths of pipe shall be set vertically and taped with a

hammer to remove scale and dust and inspected to ensure that no foreign matter is logged therein.

1.20 Piping carrying water or other fluids subject to freezing shall not be installed in locations subject to freezing. If in doubt, consult Engineer.

1.21 Pay particular attention to conflict of piping with other work. Do not install until conflict is resolved. If in doubt, consult Engineer.

1.22 Piping materials in each system shall, to the extent practicable, be of the same material. Frequent changes of material (for example, from copper to steel) shall be avoided and in no case shall be accomplished with use of insulated unions and permission of the Engineer.

PART 2 – SCOPE OF WORK:

2.1 Furnish all material, labor, tools, equipment, and supervision required for the renovation and extension of the existing fire protection system as indicated on the project drawings and within these specifications. Include all necessary piping, sprinkler heads, test connections, valves, drains, etc.

2.2 The Contractor shall provide flushing and sterilization of all water lines in accordance with current Codes, Rules and Regulations and shall make connection to domestic water mains in accord with current rules and regulations of the State Department of Sanitary Engineering and Division of Water.

2.3 The Contractor shall obtain and pay for all necessary state, municipal, county, city and other permits and fees and pay all State taxes which are applicable.

2.4 All workmanship, equipment and material shall be guaranteed in writing against defects from any cause, other than misuse, for a period of one year from substantial completion.

2.5 Upon completion, the Contractor shall submit to the Engineer, a properly completed "Sprinkler Contractor's Certificate Covering Materials and Tests" form.

2.6 Upon completion of this work all debris, material, and equipment shall be removed from the building and premises; all piping shall be cleaned ready for finish painting. Do not remove rust inhibitive primer specified hereinafter.

PART 3 – SHOP DRAWINGS:

3.1 The Contractor shall prepare and submit to the Engineer, shop drawings including design calculations, detailed catalog cutsheets and layout drawings indicating the proposed automatic sprinkler system. All layouts and drawings shall be closely coordinated by the Contractor with the work of ALL other trades. The shop drawings shall indicate the following items:

- Name and address of Owner, Architect and Engineer.
- Sprinkler heads including temperature rating.
- Flanged gate and check valves.
- Pipe hangers.

3.2 On a set of drawings to the same scale as the drawings accompanying these specifications, indicate:

- Each head location coordinated with lights, diffusers, and other ceiling mounted device.
- Location of all risers, mains, runout lines, etc.
- Size of all risers, mains, runout lines, etc.

- Location and type of pipe hangers.
- All other information required by the Authority Having Jurisdiction providing approval.

3.3 The Contractor shall submit these shop drawings to the Engineer through the General Contractor and Architect for their review and approval. The Contractor shall submit the reviewed drawings to the Authority Having Jurisdiction for their review and approval. The Contractor shall incorporate all review comments from the Engineer and the Authority Having Jurisdiction. No work shall be performed onsite until all review processes are complete and updated drawings are on the job site.

PART 4 – EQUIPMENT AND MATERIALS:

4.1 BUTTERFLY VALVES: 2” AND OVER; listed and approved by UL and FM; 300-psi working pressure, grooved ends, ASTM A536, Grade 65-45-12, ductile iron body, electroless-nickel plated ductile iron disc, pressure-responsive elastomer seat and stainless steel stem. (Stem offset from the disc centerline to provide complete 360-degree circumferential seating.) Valve complete with weatherproof actuator housing with handwheel and supervisory switches. Basis of Design: Victaulic Series 705.

4.2 GATE VALVES: 2½" and over; listed and approved by UL and FM; marked SV-FM; 175# working pressure; 1 BBM; OS&Y; flanged or grooved ends; cast iron discs; bronze seat rings; four point wedging mechanism; Basis of Design: Victaulic Series 771, or engineer approved equivalent to Mueller, Scott or Lunkenheimer. 2" and under; 150# working pressure; bronze; rising stem; screwed; bronze discs; bronze seat rings; two point wedging mechanism; equivalent to Jenkins, Scott or Lunkenheimer.

4.3 CHECK VALVES: 2½" and over; listed and approved by UL and FM; marked SV-FM; 250 psi working pressure with grooved ends or 175# working pressure; 1 BBM; flanged; Basis of Design: Victaulic Series 717, or engineered approved equivalent to Mueller, Scott, or Lunkenheimer. 2" and under; 150# working pressure; bronze; screwed; equivalent to Jenkins, Scott, or Lunkenheimer.

4.4 INTERIOR PIPE & FITTINGS: Up to 2" Schedule 40 ASTM A-53 black steel; 125# cast iron screwed fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings. 2½" and larger: Schedule 40 black steel with flanged, welded or victaulic (or similar) type approved fittings or Schedule 10, ASTM A-135 black steel with victaulic or similar type approved fittings.

4.4.1 Grooved joint couplings consisting of two ductile iron housing segments to ASTM A536, grade 65-45-12; pressure responsive elastomer gasket; and ASTM A449 compliant bolts and nuts.

- Rigid Type: Housings cast with offsetting, angle-pattern, bolt pads to provide system rigidity and support and hanging in accordance with NFPA-13, fully installed at visual pad-to-pad offset contact. (Couplings that require exact gapping at specific torque ratings are not permitted.) Installation-Ready for complete installation without field disassembly. Basis of Design: Victaulic Style 107N and 009-EZ.
- Flexible Type: For use in locations where vibration attenuation and stress relief are required: Basis of Design: Victaulic Installation-Ready Style 177 or Style 77.

4.5 Do not route sprinkler piping (including drops) directly above any light fixtures. Do not route sprinkler piping near ceiling; hold tight to structure. Where large volumes occur above ceiling route pipe at least 36” above ceiling. The Sprinkler Contractor shall coordinate during design of sprinkler systems to ensure these requirements are met.

4.6 SPRINKLER HEADS: Victaulic, Gem, Grinnell, Star, Viking, Reliable, Tyco: All sprinkler heads shall be fed in a reverse bend arrangement. Sprinkler head degree ratings shall be determined by the area serviced in accord with current Codes and Standard Practices.

4.6.1 Sprinklers shall be glass bulb type, with hex shaped wrench boss integrally cast into the sprinkler body to reduce the risk of damage during installation.

4.6.2 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss integrally cast in the sprinkler body.

4.6.3 Contractor shall be responsible to match sprinkler type within existing compartments as needed. Standard response and quick response sprinklers shall not be installed in the same compartment as defined by NFPA 13.

4.6.4 Types of sprinkler heads shall be as follows:

- Semi-Recessed, Quick Response – Reliable (or equal) Model F1FR-300 or Victaulic Model V27 semi-recessed automatic sprinkler head. Escutcheon and head shall be white.
- Upright, Quick Response – Reliable (or equal) Model F1FR or Victaulic Model V27 Vertical Upright automatic sprinkler head.
- Sidewall, Quick Response – Reliable (or equal) Model GFR or Victaulic Model V27, horizontal sidewall automatic sprinkler head.
- Concealed, Quick Response – Reliable (or equal) Model G4A or Victaulic Model V38, Concealed automatic sprinkler head. Cover shall be white.
- Caged, Pendent, Quick Response – Reliable (or equal) Model F1FR or Victaulic Model V27 Vertical Upright automatic sprinkler head with D1 cage.

4.7 At the Contractor's option, extended coverage sprinkler heads may be used where appropriate.

4.8 At the Contractor's option, code approved flexible sprinkler heads may be used where appropriate and in compliance with the installation requirements of these specifications.

4.8.1 In lieu of rigid pipe offsets or return bends for sprinkler drops, the Victaulic VicFlex™ Multiple-Use Flexible Stainless Steel Sprinkler Drop System [with captured coupling Style 108] may be used to locate sprinklers as required by final finished ceiling tiles and walls. The drop system shall consist of a braided type 304 stainless steel flexible tube, zinc plated steel Male threaded nipple or Victaulic FireLock IGS Groove Style 108 coupling for connection to branch-line piping, and a zinc plated steel reducer with a female thread for connection to the sprinkler head.

4.8.2 The drop shall include a UL approved Series AH1 with 3" bend radius; AH2 or AH2-CC braided hose with a bend radius to 2" to allow for proper installation in confined spaces.

4.8.3 Union joints shall be provided for ease of installation.

4.8.4 The flexible drop shall attach to the ceiling grid using a one-piece open gate Series AB1 or AB2 bracket. The bracket shall allow installation before the ceiling tile is in place.

4.8.5 The braided drop system is UL listed for sprinkler services to 175 psi (1206 kPa) and FM Approved to 200 psi (1380 kPa).

4.9 Where sprinkler heads are installed in a tile ceiling, they shall be installed in the middle of the tiles, at half or quarter points along the length of the tiles.

4.10 Coordinate sprinkler head locations in kitchen freezer/cooler units with light fixtures and other ceiling mounted devices to ensure proper coverage is maintained. Provide these heads with cages. Seal freezer/cooler panels where pipe penetrations occur.

4.11 CLAMPS AND ANCHORS: Furnish and install approved clamps, as required, at all (45 degree) l/8 bends, (90 degree) ¼ bends and flange and spigot pieces to the straight pipe to ensure permanent anchorage of all fire lines. Fittings, clamps, clamp rods, nuts, washers, and glands shall be factory zinc-coated.

4.12 HANGERS: All piping shall be adequately and permanently supported in an approved manner on approved hangers. Minimally support piping on 8 foot intervals for pipe 3” and smaller; 10 foot intervals for larger piping. Also support within 24” of changes in direction and end of runs. Reference Specification Section 202500 for additional information.

4.13 SLEEVES AND ESCUTCHEON PLATES: Furnish and install sleeves for pipes where piping penetrates masonry walls; exterior wall sleeves to be watertight. Fire and smoke stop all penetrations through fire and smoke walls and coordinate with General Contractor for locations. Furnish and install cast brass chrome plated split ring type escutcheons where piping penetrates walls, ceilings, and floors, whether in finished areas or not.

4.14 INSPECTION TEST CONNECTIONS & PRESSURE GAUGES: A 1" inspection test connection as required by the Building Code. Discharge shall run to open air. Control valve for test connection shall be installed not over 7' above the floor. A pressure gauge at the inspection. Test connection at each location indicated on the Plans. Pressure gauges shall be 2½" diameter and readable from the floor.

4.15 SIGNS: Appropriate code approved and required signs shall be installed on all control valves, drains, inspector's test, etc., indicating the function, installation, etc. Signs shall be neatly affixed with rust inhibitive screws, rivets or where hung from piping; with stainless steel No. 14 AWG wire.

PART 5 – SYSTEM DRAINAGE:

5.1 The entire System except that part which is below grade and will not freeze shall be installed so as to allow 100% drainage.

5.2 All sprinkler branch piping shall be installed so as to drain back to the main riser.

5.3 Approved 2" drawoff piping shall be provided on sprinkler risers with discharge piping running to nearest floor drain or open air.

5.4 Where sprinkler piping is trapped, an approved auxiliary draw-off shall be provided and neatly installed.

5.5 All draw-offs shall have a metal tag labeled "Sprinkler Drain".

PART 6 – INSPECTIONS AND TESTS:

6.1 Furnish all labor, equipment and conduct all required tests in the presence of the Owner and Engineer or designated representative if requested. Coordinate with Owner and Engineer prior to testing.

6.2 All interior and exterior piping and devices comprising the fire protection system shall be tested under hydrostatic pressure of not less than 200 PSI and maintained for not less than two (2)

hours. Any leaks or cracks developing as a result of these tests shall be repaired to the satisfaction of the Owner.

6.3 Upon completion of their work, the Contractor shall submit a written and signed certificate to the Engineer indicating that they performed the above prescribed tests and rectified all malfunctions arising therefrom.

END OF FIRE PROTECTION SYSTEM

SECTION 22 01 00 - PLUMBING SPECIALTIES

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Contractor shall provide all equipment and specialties complete with trim required and connect in a manner conforming to the State Plumbing Code.

1.3 The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of the rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.

1.4 All equipment and specialties shall be new. All equipment and specialties shall be installed as recommended by the manufacturer.

1.5 Prior to final inspection, test by operation at least twice, all equipment. Also, remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from equipment and specialties and thoroughly clean same.

1.6 All equipment and specialties shall be installed in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost.

1.7 Provide all drainage specialties indicated, specified and/or required to provide complete and acceptable removal of all storm, sanitary, waste, laboratory waste, etc. from the building and into approved receptors. Drainage specialties shall be on non-electrolytic conduction to the material to which they are connected. Drainage specialties shall be installed in a manner so as to ensure no leakage of toxic or odorous gases or liquids and shall have traps and/or backflow preventers where required. Nor shall they allow backflow into other or existing systems.

PART 2 - CLEANOUTS:

2.1 CLEANOUTS: In addition to cleanouts indicated on the drawings, provide cleanouts in soil and waste piping and storm drainage at the following minimum locations:

- At base of each stack.
- At fifty (50) foot maximum intervals in horizontal lines.
- At each change of direction of a horizontal line.
- As required to permit rodding of entire system.
- As required by current State Plumbing/Building Codes.

2.2 Water closets, mop sinks/basins and other fixtures with fixed traps shall not be accepted as cleanouts.

2.3 Cleanouts and/or test tees concealed in inaccessible pipe spaces, walls and other locations shall have an eight (8) inch by eight (8) inch (minimum) access panel or cover plates shall be set flush with finished floors and walls and shall be key or screwdriver operable.

2.4 Access panels for cleanouts shall be of the Zurn 1460 series or equivalent by Josam or Wade. Where they are not to receive paint, they shall be polished bronze unless otherwise indicated where they are to receive paint or other finishes.

2.5 Cleanouts and access panels shall be sized so as to permit the entry of a full sized rodding head capable of one hundred percent circumferential coverage of the line served.

2.6 Provide a non-hardening mixture of graphite and grease on threads of all screwed cleanouts during installation.

2.7 Do not install cleanouts against walls, partitions, etc. where rodding will be difficult or impossible. Extend past the obstruction.

2.8 In finished walls, floors, etc., ensure that cleanouts are installed flush with finished surfaces and, where required, grout or otherwise finish in a neat and workmanlike manner.

2.9 EXTERIOR CLEANOUTS (ECO): Provide exterior cleanouts where indicated for all sanitary and storm lines leaving the building within 5’-0” of building perimeter. Permanently locate all exterior cleanouts with 12”x12”x12” solid finished concrete marker slightly above grade in grass areas or flush in concrete or pavement areas. Label "CO". Zurn Z-1400-HD cleanout with tractor cover for exterior locations. Provide concrete supporting pad crowned to shed water.

2.10 Cleanouts shall be as manufactured by Zurn, Josam, Wade, Ancon, Jay R. Smith, similar to the following:

- Zurn Z-1440 or Z-1445 cleanout tee at base of exposed stack and at change in direction of exposed lines.
- Zurn Z-1440 cleanout or Z-1445-1 cleanout tee where stacks are concealed in finished walls.
- Zurn ZN-1400-T cleanout with scoriated top in finished concrete and masonry tile floors.
- Zurn ZN-1400-Tx cleanout with square recessed top for VCT and linoleum finished floors.
- Zurn ZN-1400-Z cleanout with round recessed top for poured floors.
- Mueller D-731 or D-714, Nibco, Flage or equivalent for cleanouts in copper waste with cover plates and/or access panels listed for other cleanouts.
- Threaded hex head type cleanouts of same materials as pipe for piping 2" and smaller.
- Zurn cleanout with round top with adjustable retainer for carpet area. Install flush with carpet.

PART 3 – FLOOR DRAINS:

3.1 FLOOR DRAINS: Provide floor drains at locations indicated and/or as required by State Plumbing/Building Codes. Install in a neat and workmanlike manner. Install floor drains in strict accordance with manufacturer's recommendations and the State Plumbing and Building Codes. Coordinate locations with General Contractor to ensure floor pitch to drain where required. Refer to trap primer detail(s) for where floor drains require trap primer connections. All detail indicated floor drains shall have trap primers by means of trap primer connections to the drain body, drain trap, or trap primer adapter, in accordance with the plumbing code.

3.2 Ensure by coordination with the General Contractor that spaces served with floor drains on all floors above the lowest level have a water seal extending at least three (3) inches from the floor. Also, for these locations, provide a 36”x36”, four (4) pound sheet lead flashing sheet and clamping collar or a 30 mil chlorinated polyethylene shower pan liner. Lead pans shall be given a heavy coat of asphaltum on bottom and sides before installation and a heavy coat on any exposed surfaces. After installation, provide one ply of fifteen (15) pound roofing felt beneath each pan.

3.3 The floor drains shall be Zurn, Josam, Smith, Wade, Watts Drainage, Ancon, similar to the following:

- FD-1 - Zurn, ZN-415 floor drain with 6"dia. nickel bronze strainer, Type "B", dura-coated cast iron body with bottom 3" outlet.
- FD-2 - Zurn, ZN-415E floor drain with 6"dia. nickel bronze strainer, Type "B", dura-coated cast iron body with bottom 3" outlet. Provide with 4" diameter funnel.
- FS-1 – Zurn Z1900 Sani-Flor Receptor 12" x 12" x 6" deep cast iron body and square, light-duty grate with 1/2" slotted openings, white acid resisting porcelain enamel interior and top, complete with white ABS anti-splash interior bottom dome strainer. Provide with ¾ grate and 4" pipe connection.

PART 4 – ROOF DRAINS:

4.1 ROOF DRAINS: Provide roof drains at locations indicated within the Contract Documents. Install in a neat and workmanlike manner. Install roof drains in strict accordance with manufacturer's recommendations and the State Plumbing and Building Codes. Coordinate locations with General Contractor to ensure pitch to drain.

4.2 Provide roof drains with accessories as required to match roof construction. Provide water tight seal at the connection of the body to the dome, to prevent roof water from entering into the body.

4.3 Adjust all water level regulators for overflow roof drains in the field.

4.4 The roof drains shall be Zurn, Josam, Smith, Wade, Watts Drainage, Ancon, similar to the following:

- RD-1 – 6" Zurn ZC-100-DP roof drain, sump receiver, deck plate, cast iron dome strainer. Size per plans.
- RD-1A – 6" Zurn, ZC-100-AW-C with aluminum dome, adjustable water level regulator, under deck clamp, cast iron body. Size per plans.

PART 5 – FREEZEPROOF WALL HYDRANTS:

5.1 FREEZEPROOF WALL HYDRANTS: Provide code approved wall hydrants at each location indicated in a neat and workmanlike manner. Affix tight to walls and ensure that the feed piping is on the heated side of the building insulation blanket. Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in accordance with the manufacturer's recommendations and the Building Code. Where required by the State Plumbing Code, install code approved vacuum breakers in each water supply specialty.

5.2 Wall hydrants shall be Zurn 1320 or equivalent, 3/4", with half-turn ceramic cartridge, encased, flush, non-freeze, anti-siphon, automatic draining wall hydrant with key lock and combination backflow preventer/vacuum breaker.

5.3 Mount all wall hydrants at least twenty (20) inches above finished exterior grade. Where this is not possible or practical, contact Engineer for direction.

5.4 Turn over for each hydrant, an operator key in an envelope labeled "Exterior Wall Hydrants" to Owner upon completion of the project. Where hydrants have lockable boxes, turn over an operator key for each in an envelope labeled "Exterior Wall Hydrant Locks" to Owner upon completion of project.

PART 6 – INTERIOR HOSE BIBBS AND DRAIN VALVES:

6.1 HOSE BIBBS AND DRAIN VALVES: Provide code approved hose bibbs and drain valves at each location indicated in a neat and workmanlike manner. Affix hose bibs tight to walls. Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in accordance with the manufacturer's recommendations and the Building Code. Where required by the State Plumbing Code, install code approved vacuum breakers in each water supply specialty.

6.2 HOSE BIBBS (HB): Provide code approved hose bibbs with vacuum breakers and male threaded spouts at each location indicated on the drawings. The hose bibbs shall be Woodford Model 24 (or equal) with loose key handle polished chrome finish, brass construction. Hose bibbs shall be mounted at eighteen (18) inches above finished floor. Do not install hose bibbs in spaces which do not have floor drains. Provide recessed hose bibbs in toilet rooms with floor drains, Woodford Model B75. Locate adjacent to ADA water closet.

6.3 DRAIN VALVES: Install 3/4 inch bronze body drains, similar and equivalent to Nibco, No. 72 or 73, as indicated and at the following locations:

- At the low point and isolatable section of the plumbing system.
- At each low point and isolatable section of the hydronic system.
- At each isolatable pipe section.
- At each water heater.
- At each storage tank.
- At each boiler.
- At each heat pump.
- At each water-to-water unit.
- At each chiller.
- At each pump suction.
- Install a code approved vacuum breaker where installation on to domestic water system.

PART 7 – WATER HAMMER ARRESTORS (WHA):

7.1 WATER HAMMER ARRESTORS (WHA): Provide water hammer arrestors at each location indicated below and/or as required to eliminate hydrostatic on the domestic water system. Install in an accessible location and in a neat and workmanlike manner. Provide all water supply specialties indicated, specified and/or required for the complete installation. Install in accordance with the manufacturer's recommendations and the Building Code. Where required by the State Plumbing Code, install code approved vacuum breakers in each water supply specialty.

7.2 Water hammer arrestors shall be Zurn, Z-1700, Shoktrol, Smith, Josam, Wade or equivalent. Water hammer arrestors shall be stainless steel, bellows type. Field fabricated capped cylinders shall not be acceptable. Provide insulating unions where arrestors are of dissimilar material from the piping served (unless piping is non-conducting, such as ABS or PVC).

7.3 MULTIPLE FIXTURES – BRANCH LINE LESS THAN 20’ LONG: The preferred location for a Zurn Shoktrol is at the end of the branch line between the last two fixtures served when the branch lines do not exceed 20’ in length, from the start of the horizontal branch line to the last fixture supply on this line.

7.4 MULTIPLE FIXTURES – BRANCH LINE MORE THAN 20’ LONG: On branch lines over 20’ in length, use two Shoktrols whose capacities total the requirement of the branch. Locate one unit between the last and next to last fixture and the other unit approximately midway between the fixtures.

7.5 Provide at least one water hammer arrestor at all quick acting valve locations including:

- Clothes Washers – Type “A”
- Commercial Dishwashers – Type “B”
- Sterilizers – Type “B”
- Mop Basins, downstream of check valves – Type “A”
- Flush valve fixtures – Type “B”, each toilet room with 1-3 flush valve fixtures shall have its own Type “B” water hammer arrestor.

7.6 ARRESTOR SCHEDULE:

Mark	Zurn Model Z-1700	Fixture Units	P.D.I. Size
Type “A”	#100	1-11	A
Type “B”	#200	12-32	B
Type “C”	#300	33-60	C
Type “D”	#400	61-113	D

PART 8 - OTHER SPECIALTIES:

8.1 VACUUM BREAKERS AND BACK FLOW PREVENTERS: Where required by the Building Code, whether indicated or not, provide approved vacuum breakers or backflow preventers at the following locations.

- Where domestic water system connects to a limited area fire protection system.
- Where domestic water system connects to hydronic system.
- At any threaded hose tap on the domestic water system.
- At all mop basins, provide check valves to the hot and cold water supply upstream of the faucet.

8.2 ROOF FLASHINGS: All plumbing vents or other plumbing passing thru the roof shall be flashed as approved by the State Plumbing and Building Codes and as recommended by the roofing manufacturer and/or Contractor.

END OF PLUMBING SPECIALTIES

SECTION 22 02 00 - PLUMBING FIXTURES, FITTINGS AND TRIM

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Contractor shall provide all fixtures complete with trim required and connect in a manner conforming to the State Plumbing Code.

1.3 The Contractor shall obtain exact centerline rough-in dimensions between partitions, walls, etc. as required for lay-out of the rough-in work. All work shall be roughed-in so that all exposed piping will be straight and true without bends or offsets.

1.4 All fixtures and trim shall be new. All fixtures and trim shall be installed as recommended by the manufacturer. All fixtures shall be set level and true and shall be caulked into finished walls, floors, etc. in a neat and workmanlike manner with an approved waterproof non-yellowing caulk for such service. All fixtures and trim hall be installed in a neat and workmanlike manner. Unacceptable workmanship shall be removed and replaced at the installing Contractor's cost. Pay particular attention to flush valves and bracket concealed portion to building structure during rough-in. Loose, shaky flush valves, lavatories, etc. shall not be acceptable.

1.5 Handicapped accessible fixtures shall be mounted as recommended by the Building Code and ADA. Special Note for Handicap Grab Rails: Coordinate top of shower valves, flush valves, flush tank, etc., with location of grab rails as shown on the architectural plans. The Contractor shall install all items to allow for installation, removal, and service without removal of the grab bar.

1.6 Fixture seats shall be Church model 2155CTJ, elongated open front less cover w/ JUST-LIFT, STA-TITE check hinge and DuraGuard Antimicrobial Agent, or approved equal.

1.7 All exposed piping, stops, traps, tailpieces, etc. shall be code approved chrome plated brass unless otherwise indicated or specified. Where acid resistant piping is indicated on the drawing or the specifications, all piping and ancillary components from the sink/lavatory to dilution basin shall be acid resistant as specified and required by code.

1.8 Water supplies shall connect through walls with stops and chrome plated escutcheons with set screws. In general, furnish drinking fountains, wall-hung lavatories, and hose bibbs with manual loose key stop valves. For all other fixtures, furnish with manual permanent-key stop valves (i.e. sinks in casework, etc.). When in doubt, contact Engineer prior to installation.

1.9 Coordinate all stainless steel sinks with architectural casework shop drawings for appropriate fit. Do not order sinks until this has been coordinated. Change Orders will be immediately rejected for lack of coordination during construction.

1.10 Test for appropriate operation at least twice, ALL fixtures and trim including hands-free trim. Open all faucets and allow to run for fifteen (15) minutes, then remove all faucet aerators and thoroughly clean until smooth flow is obtained. Test by operation at least twice, adequate flow of water at flush valves including appropriate adjustment of hands-free devices, faucets including appropriate adjustment of hands-free devices, hose bibbs, fixture drains, shower heads, etc.

1.11 Remove all stick-on labels, dirt, grease, other removable stampings, lettering, etc. from plumbing fixtures and thoroughly clean same.

1.12 ACCEPTABLE MANUFACTURERS: Subject to compliance with requirement's manufacturers offering plumbing fixtures and trim which may be incorporated in the work include only the following:

1.12.1 Plumbing Fixtures: American Standard, Kohler, Zurn, Sloan

1.12.2 Plumbing Trim: American Standard, Chicago Faucet, Kohler, Delta Commercial, T&S Brass, Just, Speakman, Zurn Aqua-Spec, Moen Commercial, Symmons

1.12.3 Flush Valves: Sloan, Zurn, Delany

1.12.4 Stainless Steel Sinks: Elkay, Just, Moen Commercial, Sterling

1.12.5 Appliance Connection Boxes: Guy Gray, Oatley, Wolverine

1.12.6 Fixture Seats: Bemis, Church, Olsonite

1.12.7 Fixture Carriers: Josam, Kohler, Tyler Pipe, Zurn, Wade, Smith, Watts

1.12.8 Lavatory, Sink, Mop Basin, and Laundry Tub Strainers: American Standard, Elkay, Kohler, McGuire., Sloan, Zurn.

1.12.9 P-traps, Tailpieces, and Escutcheons: American Standard, Elkay, Kohler, McGuire, Moen Commercial, Sloan, Zurn.

1.12.10 P-trap Insulation covering for ADA Fixtures: IPS Corp., McGuire, Plumberex.

1.12.11 Water supplies and stops: American Standard, Elkay, Kohler, McGuire, Moen Commercial, Nibco, Sloan, Watts, Zurn,

PART 2 – PLUMBING FIXTURE SPECIFICATIONS:

P-1 WATER CLOSET – FLUSH VALVE, WALL MOUNTED – ADA HEIGHT
Zurn model Z5615-BWL vitreous china, elongated rim, siphon action water closet. Provide 1½" top spud, solid plastic elongated seat with open front, extended back, and check hinge. Provide with concealed carrier. Mount seat at 18" AFF. Install flush valve on "open" side of water closet. Water closet flush valve shall be as follows:

- Manual ADA flush valve shall be Zurn model Z6000-WS1. Top of flush valve handle shall be a maximum of 31-1/4" A.F.F.

P-1A WATER CLOSET – FLUSH VALVE, FLOOR MOUNTED – ADA HEIGHT
Zurn model Z5660, vitreous china, 18" high, siphon jet, 1-1/2" top spud, elongated bowl, china bolt caps and white open front plastic seat with check hinge. Install flush valve on "open" side of water closet. Water closet flush valve shall be as follows:

- Manual ADA flush valve shall be Zurn model Z6000-WS1. Top of flush valve handle shall be a maximum of 31-1/4" A.F.F.

P-1B WATER CLOSET – FLUSH TANK – ADA HEIGHT
Zurn model Z5560, 1.6 GPF, pressure assist, vitreous china, close coupled, two-piece, water closet with elongated bowl and white open front plastic seat with check hinge and bolt caps. Mount seat at 18" A.F.F.

P-2 LAVATORY – WALL-HUNG, BACKSPLASH – ADA COMPLIANT
Zurn model Z5344, 20”x18” vitreous china lavatory with backsplash, rectangular basin, splash lip, front overflow, and 4” center faucet holes. Provide with concealed arm support and wall carrier. Provide lavatory drain with integral perforated strainer, 3/8" angle rigid supplies with stops and P-trap. Install insulation on the supply lines and P-trap similar to Brocar “Trap Wrap” vinyl plastic covering per ADA Standards. Mounting height to be per ADA. Lavatory trim shall be as follows:

- Single handle faucet shall be Zurn model Z81000-3M with polished chrome-plated cast brass faucet body on 4” centers with single lever control. Furnish with 0.5 GPM vandal-resistant aerator.

P-3 STAINLESS STEEL 17" X 20" X 5" SINGLE BOWL DROP-IN ADA SINK
Elkay Lustertone® Classic Stainless Steel (lrad172050) 17" x 20" x 5" Single Bowl Drop-in ADA Sink. Sink is manufactured from 18 gauge 304 Stainless Steel with a Lustrous Satin finish, Rear Center drain placement, and Bottom only pads. Sink trim shall be as follows:

- Single handle faucet shall be Zurn model Z81000-3M with polished chrome-plated cast brass faucet body on 4” centers with single lever control. Furnish with 0.5 GPM vandal-resistant aerator.

P-4 WASHING MACHINE CONNECTION BOX
Guy Gray Model #WB200HA, 2" drain outlet, 16 gauge steel with epoxy finish and integral water hammer arrestors. Field paint exposed portions of box to match adjacent wall surfaces.

P-5 ICE MAKER CONNECTION BOX
IPS Corporation Water-Tite mini round ice maker outlet box with integral water hammer arrestor and preloaded nails. Connect cold water supply line to water supply at adjacent sink. Field paint exposed portions of box to match adjacent wall surfaces.

END OF PLUMBING FIXTURES, FITTINGS, AND TRIM

SECTION 23 02 00 - HVAC EQUIPMENT

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 The Contractor shall provide in complete working order the heating, ventilation and air conditioning equipment located as indicated and installed, connected, and placed in operation in strict accordance with the manufacturer's recommendations. All equipment shall be factory painted and, where applicable, factory insulated and shall, where such standards exist, bear the label of the Underwriters Laboratory.

1.3 All Contractors and Vendors providing a bid for this project shall review the Plans and Specifications and determine any modifications and/or adjustments necessary relative to the proposed equipment and materials with specific manufacturer’s installation requirements. Include in the bid any necessary installation methods, features, options, accessories, etc. necessary to install the proposed equipment and materials, regardless of whether used as basis of design or being offered as a substitution in accordance with the specific manufacturer’s installation requirements whether specifically detailed or not within the Plans and Specifications.

1.4 All equipment, material and labor warranties shall be furnished by the equipment supplier/vendor. All warranties begin on the date of Substantial Completion. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for special warranty requirements.

1.5 Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for minimum required Schedule of Values breakdown.

1.6 Review the Specification Section – REQUIRED SHOP DRAWINGS, ETC., and provide all documentations called for therein.

1.7 Each subcontractor shall be responsible for their own completion of System Verification Checklists/Manufacturer’s Checklists. Refer to Specification Section GENERAL PROVISIONS – MECHANICAL for additional requirements. Factory startup is required for all HVAC equipment. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians and shall complete and submit start-up reports/checklists. This shall include the following:

- VRF Systems
- Rooftop Units
- Exhaust Fans
- Ductless Split Units

1.8 All HVAC equipment shall comply with the latest provisions of ASHRAE Standard 90.1 and all provisions of the International Energy Conservation Code.

1.9 Ensure that the equipment that is proposed to be furnish may be installed, connected, placed in operation, and easily maintained at the location and in the space allocated for it.

1.10 The contractor and vendor shall confirm connection sides for each piece of equipment specific to this project.

1.11 Determine from the Bid Documents the date of completion of this project and ensure that equipment delivery schedules can be met to allow this completion date to be met.

1.12 Through coordination with other Contractors, Vendors and Suppliers associated with this Project, this Contractor shall ensure a complete, 100% functional, tested, inspected, and approved systems. Claims for additional cost or change orders will immediately be rejected. Refer to Specification Section - ELECTRIC MOTORS, ETC. for additional requirements. All equipment shall be furnished for a single point electrical connection unless specifically excluded as a requirement.

1.13 Review the Specification Section - CONTROLS to determine controls, including variable frequency drives, to be furnished. Where manufacturer's temperature controls are specified, they shall be in full compliance with NFPA 90A including automatic smoke shut down provisions.

1.14 Review the Specification Section – TESTING, BALANCING, LUBRICATION AND ADJUSTMENTS. For all belt driven equipment, provide final fan and motor sheaves as determined by the air balance contractor during project balancing phase. The mechanical contractor shall install any new sheaves and belts as required for balancing.

PART 2 – CENTIFUGAL INLINE EXHAUSTER, DIRECT DRIVE:

2.1 SQUARE INLINE CENTRIFUGAL FANS

2.1.1 Square Inline Centrifugal Fans: Direct-driven, square, inline fan suitable for duct installations handling clean ventilation air.
- Basis of Design Product: **Twin City Fan & Blower, Model DSI**.
- Permanently attach nameplate displaying serial number and unit information.

2.1.2 Housing: Heavy-gauge aluminum with continuously gasketed contact surfaces.
- Provide inlet venturi matched to fan wheel.
- Provide removable side panels for maintenance.
- Construct fan to allow complete removal of motor and fan wheel when side panel is removed.
- Provide universal mounting brackets to allow for horizontal or vertical fan orientation.
- Provide one inch thick fiberglass [neoprene coated] [foil faced] insulation liner in fan housing. Do not expose fiberglass to moving airstream.

2.1.3 Fan Wheels: Aluminum hub and non-overloading wheel with backward-inclined blades, statically and dynamically balanced.

2.1.4 Motors: Comply with NEMA MG-1 for designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 section "Common Motor Requirements for HVAC Equipment."
- Enclosure Type: Totally Enclosed Fan Cooled.
- Provide premium efficiency motor, suitable for inverter duty.
- Provide unfused disconnect switch, NEMA 3R, selected in accordance with Division 26 section "Enclosed Switches."

2.1.5 Ship disconnect switch loose for field mounting and wiring.

2.16 Accessories:
- Integral Speed Controller: Motor mounted speed control to reduce speed from 100 to less than 50 percent.
- Backdraft Damper, Motorized, parallel-blade type. Adjust backdraft damper to close when fan is not running.

2.17 Fabricate frame from galvanized steel.

2.18 Fabricate blades from aluminum, mill finish, with vinyl edge seals.

2.19 Provide spring vibration isolators or isolation hangers.

2.20 APPROVED MANUFACTURES: Twin City, Greenheck, Penn, ACME or Cook.

PART 3 – CENTIFUGAL ROOF EXHAUSTER, DOWNBLAST OR UPBLAST, BELT DRIVEN:

3.1 GENERAL:

3.1.1 Roof mounted exhaust fans shall be of the belt driven centrifugal type, Model BCRD or BCRU (Spun Aluminum Housing), as manufactured by Twin City Fan & Blower, Minneapolis, Minnesota.

3.2 PERFORMANCE:

3.2.1 Fans shall be tested in accordance with AMCA 211 and AMCA 311 test codes for air moving devices and shall be guaranteed by the manufacturer to deliver rated published performance levels. Fans shall be licensed to bear the AMCA certified ratings seal for both sound and air. Models shall be cULus 705 listed.

3.3 CONSTRUCTION:

3.3.1 Fan housings shall be constructed of spun aluminum and shall offer finish durability and aesthetic appearance. Fan spinnings shall have a rolled bead edge for rigidity. All units have a deep venturi inlet to prevent snow and rain entry into the building. The curb cap shall include prepunched mounting holes for ease of installation. A conduit chase constructed of electrical metallic tubing shall be provided to the motor compartment. The curb base shall have continuously welded corners for maximum leak protection. Lifting lugs shall be provided inside the motor compartment for ease of handling and installation. Fans shall bear a permanently attached nameplate displaying model and serial number of the unit for future identification.

3.4 MOTOR AND DRIVE ASSEMBLY:

3.4.1 Motor and drive assembly shall be mounted on vibration isolators to eliminate vibration and noise transmission into the ductwork. Motors and drives shall be mounted out of the exhaust airstream.

3.5 WHEEL:

3.5.1 Fan wheels shall be of the centrifugal backward inclined type, constructed of aluminum and containing a matching inlet venturi for optimum unit performance. Wheels shall be statically and dynamically balanced.

3.6 SHAFT:

3.6.1 Fan shafts shall be precision-ground and polished. Shafts shall have a first critical speed of at least 125% of the fan's maximum operating speed.

3.7 BEARINGS:

3.7.1 Bearings shall be of the one-piece, pillow block type with relubricable zerk fittings. Bearings shall be designed for air handling service with a minimum L-10 life in excess of 100,000 hours; L-60 500,000 hours at the maximum cataloged operating speed. Bearing mounting plate shall have self-aligning tabs for exact locating and alignment of bearings.

3.8 DRIVE:

3.8.1 Drive assembly shall be constructed of heavy-gauge galvanized steel. Drives shall be sized for a minimum of 150% of driven horsepower. Machined, cast iron motor sheaves shall be adjustable for final system balance.

3.9 MOTOR:

3.9.1 Motors shall be heavy-duty ball bearing type, closely matched to the fan load. All single-phase motors shall contain thermal overload protection. All motors shall be UL and/or CSA recognized. Motor adjustment shall allow precise belt tensioning for optimum belt life and one-person adjustment and servicing.

3.10 DISSCONNECT SWITCH:

3.10.1 A NEMA 3R disconnect switch shall be supplied with wiring leading from the motor to the junction box (ODP and TEFC motors).

3.11 ACCESSORIES:

3.11.1 When specified, accessories such as backdraft damper, roof curb, curb hinge, retaining chain, security hasp, NEMA-4 disconnect switch, 2-speed switch, firestat, aluminum bird screen, aluminum insect screen, and special coatings shall be provided by Twin City Fan & Blower to maintain one source responsibility.

3.12 APPROVED MANUFACTURES: Twin City, Greenheck, Penn, Jenco or Cook.

PART 4 – PACKAGED ROOFTOP UNIT WITH GAS HEAT (RTU-1):

4.1 GENERAL

- Units are designed for convertible airflow orientation to serve downflow or horizontal applications.
- All units are charged with R-410A refrigerant and run-tested at the factory to check modes of operation and proper fan rotation.
- Unit meets ASHRAE 90.1 minimum efficiency requirements.
- Unit shall be designed to conform to ASHRAE 15.
- All units are rated in accordance with AHRI Standards 210/240 or 340/360.
- Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- Unit shall be designed to prevent water intrusion up to max rated external static pressure.

4.2 VOLTAGES

- Main power supply voltage, phase, and frequency must match those required by the manufacturer.

4.3 WARRANTY

- Units feature a 5-year parts and compressor warranty. Gas heat exchangers in gas/electric units include a 20-year warranty.

4.4 CABINET

- Unit cabinets are made with galvanized steel as follows, top panel 0.046” ~19-gauge, access doors 0.034” ~21-gauge, side rails 0.058” 16 gauge with a powder-paint finish on all the external surfaces. Service panels provide access to refrigeration, heating, blower, controls, and filter sections.
- Interior surfaces in the indoor air section are single wall insulated with a minimum 1/2-in. thick, minimum 1-1/2 lb./ft^3 density, flexible fiberglass insulation bonded with a phenolic binder, Aluminum foil-faced on the air side.
- Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 minimum exterior sweat criteria.
- Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- Base rails are a minimum 3-1/2” tall and include holes to allow for overhead rigging and lifting with forklifts.
- Unit includes a condensate drain pan with both vertical and horizontal drain connections.
- Unit must have ¾”-14 NPT drain connection, possible either through the bottom or side of the drain pan. Connection shall be made per manufacturer’s recommendations.
- Shall be a sloped condensate drain pan made of a corrosion resistant material.
- Unit must comply with ASHRAE Standard 62.1
- Unit shall be field convertible from vertical to horizontal airflow on all models. No special kit required.
- Base of unit shall have a thru-the-base gas (3-6 tons only) and electrical connections (factory installed or field installed), standard.

4.5 CONTROLS

- Units are factory-wired with color-coded wires with low-voltage control circuit protected by a resettable circuit breaker on the 24-v transformer side. Transformer shall have 75VA capability.
- Units have single-point power entry either with the unit or with the electrical heat kits on a central control terminal board to provide connection points conveniently and safely for essential control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, and low- and high-pressure switches.
- Unit to be provided with a terminal block for connection and control wiring.
- Units come with a grounding lug as standard.
- Units come standard with 5kA SCCR.
- DDC controls BACnet native with LonWorks connectivity addition available. Integrate into BMS or operate as standalone digital system.

4.6 COMPRESSORS

- Compressors are hermetically sealed scroll compressors and are factory mounted on rubber grommets. On units with two refrigeration circuits (7½ – 12 ½ -ton), one scroll compressor is used on each circuit.
- Compressors shall be internally protected from high discharge pressure through internal pressure relief valve and externally protected via pressure switch in the discharge line.

4.7 DRAINPAN

- Unit includes a sloped condensate drain pan made of a non-corrosive material compliant with ASHRAE Standard 62.1. Shall use a 3/4” -14 NPT drain connection, possible either through the bottom or end of the drain pan.

- Connection shall be made per manufacturer's recommendations. No base pan penetration, other than those authorized by the manufacturer, is permitted.

4.8 FILTRATION

- MERV8
- Filters are accessible through a tool-less access panel for fast and easy removal and maintenance.
- Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.

4.9 COILS

- Coils are made of internally finned copper tube mechanically bonded to aluminum plate fins and are pressure tested at the factory to ensure pressure and leak integrity. The evaporator coil and condenser coil are leak-tested to 575 psig and pressure-tested to 450 psig.
- Evaporator and condenser coils are qualified to UL 1995 burst test. Units include high- and low-pressure switches, service ports, and factory-installed filter driers. All heat pump units (DRH units) use a refrigerant accumulator.

4.10 HEATING SECTION

- Gas/Electric units include a corrosion-resistant, indirect fire, aluminized tubular steel heat exchanger with formed wrinkle bends at the inner diameter of each radius.
- Type 409 stainless steel heat exchangers are available as a factory-installed option.
- The gas heating section uses an induced draft combustion blower and a direct spark ignition system. Units are suitable for use with natural gas or propane with a field-installed kit.
- The unit heating section must include the following, high temperature limit switches, induced draft motor speed sensors, flame out rollout switch and flame proving controls.
- All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit (horizontal plane).
- Low NOx reduction shall be provided as an option to reduce nitrous oxide emissions to meet California's Air Quality Management District (SCAQMD and SJVAPCD) low-NOx emissions requirement of 14ng/J or less.
- Primary tubes and vestibule plates on low NOx units shall be 409 stainless steel. Other components shall be aluminized steel.

4.11 FANS

- Fans in 3-phase and 1-phase equipment are available with ECM direct-drive, multi-speed motors. All motors are thermally protected with permanently lubricated bearings.
- Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required. Motor to include inherent automatic-reset thermal overload protection or circuit breaker and permanent lubricated bearings.
- Evaporator blowers for sizes 3 – 12 ½ -ton consist of single width, single inlet (SWSI) type, Class II construction supply fan with aluminum fan and blades.
- Shall have slow ramp up to speed capabilities.
- Outdoor condenser fans are direct-drive, permanently lubricated, and contain overload protection.

4.12 FACTORY-INSTALLED OPTIONS

- Powered Convenience Outlet: A 120V, 15A, GFCI outlet can be powered with a step-transformer built into the unit. For use when the unit is not running.
- Return Air and/or Supply Air Smoke Detectors: Return air and/or supply air smoke detectors can be installed in the unit. To safely identify the presence of smoke inside the air conditioning system and shutdown the blower to prevent the smoke from dispersing into different zones.
- Disconnect Switch (non-fused): A disconnect switch can be installed in the unit with factory wiring complete from the switch to the unit.

- Single Point Power Connection for Power Exhaust: Factory-installed, single-point power connection for field installed power exhaust.

4.13 FIELD-INSTALLED OPTIONS

- Horizontal Economizer: Fully modulating between 0 and 100%, contains seals that meet ASHRAE 90.1 requirements. Includes controls, motor, dampers, minimum position settings, a preset linkage, a wiring harness with plug, a mixed-air temperature sensor, enthalpy or dry bulb control, and a barometric relief damper. An optional duct-mounted barometric relief damper is available. An optional return enthalpy sensor is available to provide comparative or differential enthalpy control. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable. The economizer damper type has been tested using the AMCA 511 guidelines under Section 14 “Volume Control Damper”. The dampers used on these economizers are MicroMetl NS1 series and have been tested and are listed by AMCA as Class 1A dampers. Class 1A dampers have a leakage rate of no more than 3 cfm per square foot at 1” static pressure. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor. Economizer controller shall accept a 2-10 Vdc CO_2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor air damper to provide ventilation based on the sensor input.
- Economizer controller on shall be the Honeywell® JADE® W7220 that provides:
  - 2-line LCD interface screen for setup, configuration, and troubleshooting.
  - On-board Fault Detection and Diagnostics (FDD) that senses and alerts when the economizer is not operating properly, per California Title 24.
  - Sensor failure loss of communication identification
  - Automatic sensor detection
  - Capabilities for use with multiple-speed indoor fan systems
  - Utilize digital sensors: Dry bulb and Enthalpy
  - Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.
- Power Exhaust: Power exhaust shall be used in conjunction with an integrated economizer. These accessory exhausts return air and may be used in either downflow or horizontal (duct-mounted) applications. Horizontal power exhaust shall be mounted in return ductwork. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0-100% adjustable setpoint on the economizer control. (Damper to be field installed, all wiring and accessory set-up is factory installed)
- Roof curbs: Full perimeter roof curb. Two different heights 14" and 24", allows proper installation and structure stability. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
- Freeze stat: Temperature sensing device that monitors the heat exchange to prevent the coil from freezing.

END OF HAVC EQUIPMENT

SECTION 23 11 00 - REGISTERS, GRILLES, DIFFUSERS & LOUVERS

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

PART 2 – REGISTERS, GRILLES, AND DIFFUSERS:

2.1 Acceptable R, G & D manufacturers are Krueger, Price, Anemostat, Nailor Industries, Titus, and Tuttle & Bailey. Shop drawings shall identify and list all characteristics of each device exactly as scheduled herein. Finishes for specified devices shall be selected by the Architect. Factory color samples shall be submitted with shop drawings. Devices shall be white unless noted otherwise. Aluminized steel devices are not acceptable. Steel devices are not acceptable unless specifically noted otherwise.

2.2 Include with the shop drawings a room-by-room schedule indicating devices installed. Also note ceiling types and installations.

2.3 Refer to drawings for schedule.

END OF REGISTERS, GRILLES, DIFFUSERS AND LOUVERS

SECTION 23 12 00 - SHEET METAL

PART 1 – GENERAL:

1.1 The Contractor's attention is directed to the General and Special Conditions, GENERAL PROVISIONS - MECHANICAL and to all other Contract Documents as they apply to this branch of the work. Attention is also directed to all other sections of the Contract Documents which affect the work of this section, and which are hereby made a part of the work specified in this section.

1.2 This branch of the work includes all materials, labor and accessories for the fabrication and installation of all sheet metal work as shown on the drawings and/or as specified herein. Where construction methods for various items are not indicated on the drawings or specified herein, all such work shall be fabricated and installed in accordance with the recommended methods outlined in the latest edition of SMACNA's Duct Manual and Sheet Metal Construction for Low Velocity Ventilating and Air Conditioning Systems. All equipment furnished by manufacturers shall be installed in strict accord with their recommended methods.

1.3 Ductwork shall be constructed and installed per the latest edition of the International Mechanical Code.

1.4 Ductwork shall be kept clean at all times. Ductwork stored on the job site shall be placed a minimum of 4” above the floor and shall be completely covered in plastic. Installed ductwork shall be protected with plastic. Do not install the ductwork if the building is not “dried-in”. If this is required, the entire lengths of duct shall be covered in plastic to protect. The Owner/Engineer shall periodically inspect that these procedures are followed. If deemed unacceptable, the Contractor shall be required to clean the duct system utilizing a NADCA certified Contractor.

1.5 Prior to purchase and fabrication of ductwork (shop fabricated or manufactured), the Contractor shall coordinate installations with new and existing conditions. Notify the Engineer if there are any discrepancies for resolution.

1.6 For healthcare projects, provide a SMACNA duct cleanliness level “C” per the latest SMACNA standards.

PART 2 – LOW VELOCITY DUCTWORK:

2.1 Ductwork, plenums, and other appurtenances shall be constructed of one of the following: Steel sheets, zinc coated, Federal Specification 00-S-775, Type I, Class E & ASTM A93-59T with G-90 zinc coating. Aluminum alloy sheets 3003, Federal Specification AA-A-359, Temper H-14.

2.2 Ductwork, plenums, and other appurtenances shall be constructed of the materials of the minimum weights or gauges as required by the latest SMACNA 2” W.G. Standard or below table. When gauge thickness differs, the heavier gauge shall be selected. The below table shall serve as a minimum.

Round Diameter	Duct Gauge	Rectangular Width	Duct Gauge
3-12 Inches	26 Ga.	3-12 inches	26 Ga,
12-18 Inches	24 Ga.	13-30 inches	24 Ga.
19-28 Inches	22 Ga.	31-54 inches	22 Ga.
29-36 Inches	20 Ga.	55-84 inches	20 Ga.
37-52 Inches	18 Ga.	85 inches and up	18 Ga.

2.3 All ductwork connections, fittings, joints, etc., including longitudinal and transverse joints, seams and connections shall be sealed. Seal with high velocity, smooth-textured, water based duct sealant. Sealant shall be UL 181B-M listed, UL 723 classified, NFPA 90A & 90B compliant, permanently flexible, non-flammable, and rated to 15”wg. Apply per manufacturer's recommendations. Contractors shall ensure no exposed sharp edges or burrs on ductwork.

2.4 Duct dimensions indicated are required inside clear dimensions. Plan duct layouts for adequate insulation and fitting clearance.

2.5 All angular turns shall be made with the radius of the center line of the duct equivalent to 1.5 times the width of the duct.

2.6 Cross-break all ducts where either cross sectional dimension is 18" or larger.

2.7 Ducts shall be hung by angles, rods, 18 ga. minimum straps, trapezes, etc., in accordance with SMACNA's recommended practices. Duct supports shall not exceed 12 ft intervals. There shall be no less than one set of hangers for each section of ductwork. Where ductwork contains filter sections, coils, fans or other equipment or items, such equipment or items shall be hung independently of ductwork with rods or angles. Do not suspend ducts from purlins or other weak structural members where no additional weight may be applied. If in doubt, consult the Structural Engineer.

2.8 Double turning vanes shall be installed in square turns and/or where indicated.

2.9 Provide a “high efficiency” type take-off with round damper (Flexmaster STOD-B03 or approved equal) for all round duct branches from a rectangular main to a GRD. Refer to the detail on the drawings for all installation requirements.

2.10 Air volume dampers shall be installed in each duct branch takeoffs and/or where indicated, whichever is more stringent. All such dampers shall be accessible without damage to finishes or insulation and shall be provided where required for proper system balance.

2.11 Unless otherwise dimensioned on the drawings, all diffusers, registers, and grilles shall be located aesthetically and symmetrically with respect to lighting, ceiling patterns, doors, masonry bond, etc. Locate all supply, return, and exhaust diffusers and grilles in the locations shown on the architectural reflected ceiling plan.

2.12 The interior surface of the ductwork connecting to return/exhaust air grilles shall be painted flat black. The ductwork shall be painted a minimum of 24" starting from the grille.

2.13 Provide approved flexible connectors at inlet and outlet of each item of heating and cooling equipment whether indicated or not. Install so as to facilitate removal of equipment as well as for vibration and noise control.

2.14 All fans and other vibrating equipment shall be suspended by independent vibration isolators.

2.15 Miscellaneous accessories such as test openings with covers, latches, hardware, locking devices, etc., shall be installed as recommended by SMACNA and/or as indicated. Test openings shall be placed at the inlet and discharge of all centrifugal fans, VAV boxes, fan sections of air handling units, at the end and middle of all main trunk ducts and where indicated. All such openings shall be readily accessible without damage to finishes.

2.16 Whether indicated or not, provide code approved, full sized fire dampers at all locations where ductwork penetrates fire rated walls. Fire stop rating shall meet or exceed the rating of the wall.

Provide an approved access panel at each fire damper located and sized so as to allow hand reset of each fire dampers. All such fire dampers and access panels shall be readily accessible without damage to finishes. Refer to Architectural Plans for locations of fire rated walls. All access doors shall be 16"x16" or as high as ductwork permits and 16" in length.

2.17 The Contractor who installs the sheet metal shall furnish to the Air Balancing Contractor, a qualified person to assist in testing and balancing the system.

2.18 INSULATED FLEXIBLE AIR DUCT: Thermaflex G-KM or equal. Flexible air duct shall be two (2) inch thick fiberglass insulation with CPE liner permanently bonded to a coated spring steel wire helix supporting a fiberglass scrim and fiberglass insulating blanket. Flexible air duct shall be listed under UL Standard 181 as a Class I flexible air duct complying with NFPA 90A and 90B. Maximum flame spread = 25 and maximum smoke developed = 50. Minimum insulating value is R-6.0. Flexible duct shall be used only for GRD runouts and no section shall be more than five feet in length.

2.19 FLEXIBLE CONNECTORS: Duro-Dyne, Ventfabrics, Inc., U.S. Rubber or equivalent; conforming to NFPA No. 90A; neoprene coated glass fabric; 20 oz. for low velocity ducts secured with snap lock.

2.20 TURNING VANES: Fabricated as recommended by SMACNA: noiseless when in place without mounting projections in ducts. All turning vanes shall be double blade type.

2.21 ACCESS DOORS IN DUCTWORK: Flexmaster TBSM, Air Balance, Vent Products or equal. Access doors for rectangular ducts shall be 16"x16" where possible. Otherwise install as large an access door as height permits by 16" in length. Door shall be 2” thick double-wall insulated with continuous hinge and cam lock. Provide in ducts where indicated or where required for servicing equipment whether indicated or not. Provide a hinged access door in duct adjacent to all fire, smoke, and control dampers for the purpose of determining position. Access doors shall also be provided on each side of duct coils and downstream side of VAV boxes and CAV boxes.

2.22 ARCHITECTURAL ACCESS DOORS IN CEILINGS OR WALLS: Provide Kees D Panel, Cesco, Milcor or equal. Panels shall be 24”x24” in size and constructed with 16 gauge galvannealed steel for door and frame. Provide with primer finish to accept specified finish. Door shall include three (3) screwdriver operated cam latches and concealed continuous pivoting rod hinge. Door shall open 175 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors. For fire rated units, provide manufacturer’s standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to ensure a complete project.

2.23 SECURITY ARCHITECTURAL ACCESS DOORS IN CEILINGS OR WALLS: KEES Model number: SSAP-RR. Doors shall be 24”x24” in size with the following options: continuous internal hinged welded to door and collar; continuous door stops on 3 sides; 12-gauge steel door, flange and collar, collar stitch welded to flange with continuously welded seams; 3/8” radius on door and flange; pinned Allen head security cam latches; paintable finish; cylinder lock (coordinate cylinders and keys with Owner to match facility standards). Door shall open 150 degrees. For masonry construction, furnish frames with adjustable metal masonry anchors and straps. For fire rated units, provide manufacturer’s standard insulated flush panel/doors with continuous piano hinge and self-closing mechanism. The Contractor shall include all required access doors in the bid and shall coordinate with the General Contractor prior to the bid to ensure a complete project.

2.24 VOLUME DAMPERS (RECTANGULAR): Ruskin MD35 or Air Balance, Pottorff, rectangular volume dampers. Frames shall be 16 gauge galvanized steel. Blades shall be opposed blade 16 gauge galvanized steel with triple crimped blades on 6" centers. Linkage shall be concealed in jamb. Bearings shall be ½" nylon. Maximum single section size shall be 48" wide and 72" high. Provide with Ventfabrics 2" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

2.25 VOLUME DAMPERS (ROUND): Ruskin MDRS25 or Air Balance, Pottorff round volume dampers. Dampers shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20 gauge steel and 6" long. Damper blades shall be 20 gauge crimped galvanized steel. Axle shall be 3/8"x6" square plated steel. Bearing shall be 3/8" nylon. Provide with Ventfabrics 2" high elevated dial regulator to avoid damper handle from conflicting with duct insulation. Provide permanent mark on dial regulator to mark air balance point.

2.26 FIRE DAMPERS: Fire dampers shall be Ruskin 1BD2 1½ hour rating U-215B vertical 1½ hour rating or United Air Type U-255B for a 3 hour vertical rating. Other acceptable manufacturers are Air Balance or Pottorff. Fire dampers shall be constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1½ or 3 hour fire protection rating as required by fire wall. Damper shall have a 165 degrees F fusible link and shall include a UL label in accordance with established UL labeling procedures. Fire damper shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing minimum 20 gauge steel sleeves, angles, other materials, practices required to provide an installation to that utilized by the manufacturer when dampers were tested at UL. Blade and frame thickness shall be a minimum of 24 gauge. Installation shall be in accordance with the damper manufacturer's instructions. The blades shall be out of the air stream. Provide an access door for fire damper reset at all fire damper locations. Provide factory supplied caulked sleeve, gauge as required to meet manufacturer UL installation requirements.

PART 3 – KITCHEN RANGE HOOD EXHAUST DUCT:

3.1 Ducts shall be constructed of 18 gauge stainless steel with liquid tight continuous external weld of all seams and joints where exposed. Where ducts are concealed, they shall be constructed of 16 gauge carbon steel with liquid-tight continuous weld of all seams and joints. Inside laps on duct joints shall project in a direction against the air flow.

3.2 Ducts shall be so constructed and sloped as to provide suitable drainage of grease to a collection point.

3.3 Hand holes for inspection and cleaning purposes, equipped with tight fitting sliding or swinging doors and latches, shall be provided in horizontal sections of exhaust ducts. Such openings shall be at the sides of the horizontal run in order to prevent dripping of residue. Spacing of such openings shall not exceed 20 feet and shall be located at all offsets. Openings shall have a minimum dimension of 20" in width with a height equivalent to the duct height minus one inch.

3.4 At the base of each vertical riser, a residue trap shall be provided with provisions for cleanout.

3.5 The Contractor shall install the kitchen rangehood exhaust duct systems and maintain the minimum code required clearances to combustibles. The use of UL listed and approved enclosure system of fire wraps/blankets installed per the manufacturer's instructions are acceptable when required to achieve the clearance to combustibles requirements.

3.6 At the Contractor's option, a UL2221 Pre-manufactured Duct System equal to Metal Fab 3G shall be acceptable. Duct shall have a stainless steel inner liner, aluminized outer liner and one or three inch liner as required to comply with requirements of clearance to combustibles.

3.7 Shop drawings of the kitchen rangehood exhaust ductwork shall be made and submitted to the appropriate reviewing agency. Any fees associated with this submittal shall be borne by this Contractor.

PART 4 – DISHWASHER EXHAUST DUCT:

4.1 All exposed exhaust duct shall be 22 gauge stainless steel duct with liquid tight continuous external weld of all seams and joints. All concealed exhaust duct shall be 24 gauge aluminum with liquid tight joints. Provide dielectric connection between steel and aluminum ductwork.

4.2 All ductwork shall be sloped so as to drain back toward the dishwasher.

PART 5 – DRYER VENT DUCTWORK

5.1 All dryer ducting shall be a minimum of 4" in diameter. Refer to the drawings for exact duct sizing.

5.2 Dryer vent ductwork shall be rigid metal 20-gauge aluminum duct. "Dryer ducts shall have a smooth interior finish and be supported at 4-foot intervals." Duct joints shall be installed so that the male end of the duct points in the direction of the airflow. Joints shall be secured with metal tape (not duct tape). Do not use rivets or screws in the joints or anywhere else in the duct as these will incur lint collection.

5.3 Length of concealed rigid metal ducting shall not exceed the allowable length of 35 feet. Deduct 5 feet from the allowable length for every 4" 90 degree elbow and 4" 2.5 feet for every 45 degree fitting. These lengths may vary per local codes and dryer manufacturer's recommendations. Install per 2012 IMC Section 504 Clothes Dryer Exhaust. Provide a complete, working in-line booster fan system, including power, if the maximum allowable duct length is exceeded.

5.4 Flexible transition hose connection at the dryer shall be the aluminum flexible duct type. Do not use the plastic or vinyl.

5.5 Termination of dryer venting shall be to the exterior with a proper hood or roof jack equipped with a backdraft damper. Hood/jack shall be painted with suitable exterior grade paint and color per the Owner's direction. Small orifice metal screening shall not be part of the hood or roof jack as this will trap lint and block the opening. The hood opening shall point down and maintain a minimum of 12 inches of clearance between the bottom of the hood and the ground or other obstruction.

END OF SHEET METAL

SECTION 25 04 00 - CONTROL - DIRECT DIGITAL

PART 1 – GENERAL:

1.1 The controls system for this project shall be a web-based digital controls system. All controllers, control interface hardware, services, installation, warranty, training, etc., shall be included as hereinafter specified. The system shall utilize a network controller and unitary" type controllers. Including such minor details not specifically mentioned or shown, as may be necessary for the complete operation of the system.

1.2 The Temperature Control Contractor (TCC) shall furnish all labor, materials, equipment, and service necessary for a complete and operating Building Automation System (BAS), utilizing Web Based Direct Digital Controls. All labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned shall be included for the complete, fully functional and commissioned temperature controls system.

1.3 The TCC shall provide all items, articles, materials, devices, operations, or methods listed, mentioned, or scheduled on the drawings including all labor, materials, equipment, and incidentals necessary and required for their completion to provide a complete and operating temperature control system. This will include connecting to any mechanical equipment furnished with a control interface device and contacting the equipment suppliers and/or manufacturers for information for the proper interface to the equipment being furnished.

1.4 These apparatuses shall consist of, but not limited to, all necessary thermostats, sensing devices, valves, automatic dampers, damper motors, actuators, (except automatic dampers, valves, and damper motors furnished with HVAC equipment), and with the necessary accessories for the complete control of all equipment hereinafter specified.

1.5 Control sequences are specified at the end of this section. Provide all control equipment required to perform sequences described. Coordinate all dampers with the sheet metal contractor and equipment provider. It is the responsibility of the control contractor to ensure all required dampers in the sequence of operations are provided.

1.6 Include all power wiring and cabling for the operation of the controls system. Refer to Electrical Division Specifications for additional requirements.

1.7 APPROVED MANUFACTURER'S: Alerton / PSI or match existing.

1.8 The installation shall comply with the Local Authorities and State Fire Marshal code requirements, including normal operating and smoke mode functions (where applicable). The installation shall comply with the requirements of the NEC, NFPA, UL and the Building Codes, including referenced mechanical, electrical, energy codes, etc.

PART 2 – GENERAL SYSTEM REQUIREMENTS:

2.1 All labeling for this system shall utilize actual final room names and numbers. The room names and numbers on the Contract Documents may not be the Owner's exact requirements. Coordinate with the Owner to ensure compliance.

2.2 Include in the bid for the Controls Contractor to perform additional 40 on-site hours of on-site programming, adjustments, modifications, etc. as requested by the Engineer during the warranty period after the date of substantial completion for the project.

2.3 All points of user interface shall be on standard PCs that do not require the purchase of any special software from the control's manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.

2.4 The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system integrated utilizing ANSI/ASHRAE Standard 135-2001 BACNet, OBIX TCP/IP, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

2.5 The TCC shall connect to any mechanical and electrical (power monitoring) equipment furnished with a control interface device. The TCC shall contact the equipment suppliers and/or manufacturers for information for the proper interface to the equipment being furnished. All points not provided with the equipment control interface are the responsibility of the TCC.

2.6 The operating system shall be based on a distributed control system in accordance with specifications. All building controllers, application controllers and all input/output devices shall communicate via BACnet MS/TP communication protocol. Network controller shall communicate via BACnet over Ethernet (IP).

2.7 The TCC contractor shall provide access to the system from a location determined by the Owner and from the Consulting Engineer's office (CMTA, Inc.). This shall include remote access requirements, set-up, passwords, and any software necessary to access the BAS system.

2.8 The TCC shall all have access to various types of WEB browsers (i.e. Netscape, IE, etc.), which shall be included for access to the Direct Digital Control (DDC) system via the Owner's Wide Area Network (WAN) and/or Local Area Network (LAN).

2.9 The TCC shall be responsible for coordination with the Owner's IT staff to ensure that their system will perform in the Owner's environment without disruption to any of the other activities taking place on that WAN/LAN.

PART 3 – SPECIAL PROJECT REQUIREMENTS

3.1 If TCC needs to update or revise any of the existing software, to allow their software to operate seamlessly with the owners existing server, it will be completed by the TCC as a part of this contract.

3.2 If the existing building head end software needs to be updated or revised to communicate with TCC's software, it is to be completed by the TCC as a part of the bid.

3.3 All new software, graphics, terminology, operation, trending, scheduling etc. is match any existing systems and any changes needed to accomplish this will be the responsibility of the TCC.

PART 4 – SUBMITTALS:

4.1 The TCC shall not start the project installation until the shop drawing submittals have been reviewed by the Engineer.

4.2 Submittals shall include hardware, end devices, ancillary control components, a written operating sequence, unitary control wiring, building floor plans showing communication cabling and labels as well as logic flow diagrams. All submittals shall be provided on paper and electronically in PDF format.

4.3 Submittals shall contain one control drawing per specified system and equipment. Drawing shall include point descriptors (DI, DO, AI, AO), addressing, and point names. Each point names shall be unique (within a system and between systems). For example, the point named for the mixed air temperature for AHU #1, AHU #2, and AHU #3 shall not be MAT but should be named AHU#1MAT, AHU#2MAT, and AHU#3MAT. The point names should be logical and consistent between systems and AHU's. The abbreviation or shorthand notation (e.g., MAT) shall be clearly defined in writing by the TCC.

4.4 Control diagrams shall identify: System being controlled (attach abbreviated control logic text, all digital points, analog points, virtual points, all functions (logic, math, and control) within control loop, legend for graphical icons or symbols, definition of variables or point names and detailed electric connections to all control devices and sensors.

4.5 Points list shall include all physical input/output. Points list shall be provided in both hard copy and in electronic format and shall include Name, address, engineering units, high and low alarm values, and alarm differentials for return to normal condition, default value to be used when the normal controlling value is not reporting, message and alarm reporting as specified, identification of all adjustable points and description of all points.

4.6 Submittals shall contain floor plans depicting DDC control devices (control units, network devices, LAN interface devices, and power transformers as well as static pressure sensor in duct and temperature sensors in rooms) in relation to mechanical rooms, HVAC equipment, and building footprint.

4.7 Submittals shall contain DDC system architecture diagram indicating schematic location of all control units, workstations, LAN Interface devices, gateways, etc. Indicate address and type for each control unit, Indicate protocol, baud rate, and type of LAN per control unit.

4.8 Electrical wiring diagrams shall include motor start, control, and safety circuits and detailed digital interface panel control point termination diagrams with all wire numbers and terminal block numbers identified. Indicate all required electrical wiring. Provide panel termination drawings on separate drawings. Clearly differentiate between portions of wiring that are existing, factory-installed and portions to be field-installed.

4.9 Show all electric connections of the controls system to equipment furnished by others complete to terminal points identified with manufacturer's terminal recommendations.

4.10 TCC shall provide one complete drawing that shows the control-wiring interface with equipment provided by others.

4.11 Submittals shall include project specific graphic screens for each system including a picture of the screen with a list of the variables to be placed on the screen.

4.12 Submittals shall include TCC's hardware checkout sheets and test reports.

4.13 Submittals shall include the agenda for approval by the engineer and owner of the specified training periods. See training section for requirements.

4.14 Provide complete panel drawings that are:
- Clearly labeled and schematic or drawn to scale.
- Show the internal and external component arrangement so that the operators can identify the components by their position if the labels come off.
- Wiring access routes shall also be identified so that Class 1 wiring is separated from Class 2 and 3 and so high voltage wiring is segregated from low voltage wiring.

- Complete identification of all control devices (manufacturer's type, number, and function).
- Provide details for labeling all wiring, control devices, and controllers.
- Material and equipment descriptive material such as catalog cuts, diagrams, performance curves, and other data to demonstrate conformance with specifications shall be provided.

4.15 Include room schedule including a separate line for each terminal unit, heat pump, etc. indicating location and address.

4.16 Include control valve schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: code number, configuration, fail position, pipe size, valve size, body configuration, close-off pressure, capacity, valve Cv, design pressure, and actuator type.

4.17 Include control damper schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including code number, fail position, damper type, damper operator, duct size, damper size, mounting, and actuator type.

PART 5 – O&M MANUALS AND CLOSEOUT DOCUMENTS:

5.1 Refer to Mechanical Specification Section – REQUIRED SHOP DRAWINGS, ETC. for additional requirements.

5.2 Operating instructions, maintenance procedures, parts and repair manuals shall be supplied. Repair manuals shall include detailed instructions in the setup, calibration, repair, and maintenance of all equipment furnished. Also supplied with these manuals will be a complete parts listing of all devices supplied which is to include part numbers and model numbers of all parts and component parts along with exploded views of devices.

5.3 All as built drawings (wiring diagrams, flowcharts, floor plans, etc.) shall also be supplied to the owner electronically in PDF format.

5.4 System specific wiring, control diagrams, sequence of operation and points lists shall be as installed in each control panel. This means as-built drawings, not design (submittal) drawings.

5.5 Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and downloading the entire unitary data base or any part of the automated system for backup or archiving.

5.6 Supply one copy of the software programming manual (hard copy and PDF format). The manual shall describe all furnished software. The manual shall be oriented to programmers and shall describe calling requirements, data exchange requirements, data file requirements, and other information necessary to enable proper integration, loading, testing, and program execution.

5.7 Provide a Bill of Materials with each schematic drawing. List all devices/equipment and match to schematic and actual field labeling. Provide quantity, manufacturer, actual product ordering number, description, size, accuracy, operating ranges (voltage, temperature, pressure, etc.), input/output parameters, etc.

5.8 Maintenance manual shall include copies of signed-off acceptance test forms, commissioning reports, start-up reports, etc.

5.9 The TCC shall turn over to owner two (2) sets of computerized back-ups of the complete temperature control system.

PART 6 – WARRANTY & SOFTWARE LICENSES:

6.1 Labor and materials for the control system specified shall be warranted free from defects for a period of 12 months after substantial completion and acceptance. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner.

6.2 The TCC shall respond to the Owner's request for warranty service within 24 hours during normal business hours. The TCC shall respond to the Owner's request for Emergency service (defined as life-threatening or creating the potential to cause property damage) during the warranty period within 4 hours.

6.3 The TCC shall provide technical phone support to the owner during the warranty period for warranty related issues and for two years after the warranty period. If the technical support location of the TCC is outside of the toll-free calling area for the customer, the TCC shall have a toll-free number or accept collect calls for the purpose of providing technical support.

6.4 During the warranty period, standard parts for the DDC system shall arrive at the facility within 48 hours of placing an order. Non-standard parts (requiring re-manufacturing or ordering from another supplier) shall be shipped within 96 hours.

6.5 Operator workstation software, project-specific software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the TCC shall be provided and correctly installed at no charge during the warranty period.

6.6 Provide licensed electronic copies of all software for each workstation, laptop, server. This includes but is not limited to project graphic images (editing/modifying/creating), project database, trouble-shooting and debugging programs, project-specific programming code and all other software required to operate and modify the programming code (including software at system level, primary control units, secondary control units, and all communication software). Any hardware devices (cables, protection devices) required to operate the software/hardware shall also be provided.

6.7 All additional licensing needed for this project shall be supplied by TCC. Software license shall not expire or utilize any sort of protection hardware device for its use. In any case owner shall be free to direct the modification of any software license, regardless of supplier to allow open access to all controllers. Owner shall hold the software and firmware licensing. Software license shall not expire or utilize any sort of protection hardware device for its use.

6.8 System software shall be the latest version available with upgrades provided at the end of the warranty period and shall be fully licensed to the Owner for the entire system. Supply all software necessary for configuration of, modification, editing or communicating to any of the unitary devices. Software shall be capable of uploading and downloading the entire unitary data base or any part of the automated system for backup or archiving. Software shall be "IBM compatible".

PART 7 – COMMISSIONING & VERIFICATION, FUNCTIONAL PERFORMANCE TESTING & CHECKLISTS:

7.1 100% compliance with the requirements of this section is a condition of the Owner’s acceptance and start of the warranty period.

7.2 The TCC shall be responsible for completion of (1) their hardware checkout sheets and test reports, (2) Point-by-point confirmations of ALL points – this includes visual inspection of installed components, and (3) sequence of operation confirmation.

7.3 This documentation and process shall be complete, approved and accepted by Engineer and Owner prior to acceptance. This information shall be documented as completed. A copy shall be delivered to the Engineer and Owner and included in the O&M manuals. Each subcontractor shall be responsible for completion of their own System Verification Checklists/Manufacturer's Checklists. Sample checklists shall be submitted to the Engineer and Testing Agent for approval.

7.4 Air and water balancing shall be completed (and discrepancies resolved) before the TCC's final system check and before the acceptance test to be conducted in the presence of the Engineer.

7.5 Refer to Mechanical Specification Section – GENERAL PROVISIONS for additional information and requirements.

PART 8 – WIRE MANAGEMENT, ELECTRICAL POWER, ETC:

8.1 Refer to CABLING section of this specification for additional requirements.

8.2 Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.

8.3 All wiring and cabling in mechanical and electrical rooms shall be in conduit. No wiring or conduit can be exposed to view in any other area. Conceal all wiring and cabling in conduit in wall from thermostats or other controls devices to above ceiling. Install conduit in wall from wall thermostats to above ceiling for cabling. Route wiring directly to cable tray from control points above the ceiling. Rough-in for control devices shall be in compliance with the requirements of the ELECTRICAL SPECIFICATIONS.

8.4 Any power for controls shall be fed from dedicated circuits in emergency electrical panels, when provided for a project, and shall not be obtained from receptacles, lighting, or equipment circuits. Unitary control power may be obtained from the equipment served. If power is obtained from the equipment served, the power may not be interrupted to the electronics if the equipment is off for any reason.

8.5 The TCC shall be responsible for the power source to any control panels, unitary controllers, etc. on any controlled equipment and all other control power requirements. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.

8.6 Prior to installation, ensure through coordination with all trades, that appropriate clearances (36" minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for VAV terminals, heat pumps, etc.

8.7 The TCC shall provide all CAT5 or CAT6 cabling network cabling for a complete system. This shall include cabling to the Owner's data drop. The main system data drop will be provided by others.

8.8 All control circuits within the electrical panels shall be marked to indicate equipment served.

8.9 The TCC shall perform all temperature control interlock wiring. This shall include control valves, dampers, thermostats, indoor/outdoor HVAC systems, etc. Electrical work required for system interlock and installation of the temperature control system shall be included in the bid and installed per all applicable codes. Coordinate with other trades as required for installation of a complete system.

8.10 The TCC shall be responsible for any power required for the unitary controls or control panels. This includes circuit breakers, wiring, conduit, etc. installed in strict accordance with NEC. The TCC may contract with the electrical contractor for the power wiring installation.

8.11 Provide one duplex outlet mounted inside the control panel and separately fused with a non-time delay fuse at 15 A at any panel location containing electronic control components. This receptacle may be served from the control panel 120 VAC power source.

8.12 All wiring shall be continuous runs. Any junctions must be made in metal enclosure.

8.13 Grounding terminals shall be color coded green and yellow and shall be compatible with the other specialty terminals specified above and shall mount on the same DIN rail system. Units shall be arranged so that the wiring connected to them is grounded to the enclosure via the mounting rail. These terminals shall be provided for grounding cable shields at the points where the cables enter a control panel and terminate on the control panel terminal strip. Terminals shall be Entrelec M 4/5.3A.PI or equivalent by Weidmuller, Phoenix, or Allen Bradley.

8.14 The Department of Housing, Building and Construction's Electrical Division requires that all new lighting control panels, new Building Automation Systems control panels, and new conventional HVAC control panels be certified as being constructed and wired in accordance with NFPA 70 110.3 (a) (1) and article 409.

8.15 Contractor shall ensure control panels have an identification label stating the "Certification Agency" such as UL, CSA, CE, etc. or a label of certification for each control panel by a Professional Engineer (P.E.) registered in the State of Indiana, stating that the design of the control panel was under their direct supervisory control. Include with shop drawings.

8.16 The Electrical Advisory Council for the State of Indiana requires that only an electrical contractor licensed by the State of Indiana with a licensed Master Electrician and a licensed on-site electrician can install the electrical wiring for lighting controls systems or Building Automation Systems (BAS).

PART 9 – CABLING:

9.1 Refer to WIRE MANAGEMENT section of this specification for additional requirements.

9.2 ALL CONTROL WIRING SHALL BE INSTALLED IN A WIRE MANAGEMENT SYSTEM TO INCLUDE CABLE TRAYS, BRIDLE RINGS, & CONDUITS. NO EXCEPTIONS! COORDINATE WITH ELECTRICAL CONTRACTOR TO ENSURE A COMPLETE WIRE MANGEMENT SYSTEM.

9.3 Acceptable cable manufacturers are Belden, West Penn, or Alpha.

9.4 A complete cabling system shall be furnished and installed, which shall adhere to the highest workmanlike standard of quality and appearance. Cabling shall be installed square with building lines and contained within a wire management system.

9.5 All sizing of cabling shall be according to manufacturer's recommendations but shall be a minimum of 18 AWG.

9.6 Furnish a floor plan of the building indicating communication cable labeling and routing as well as addresses and branch wiring from the unitary devices. All cabling shall be labeled on both ends. The type, size and label of all cabling shall be indicated on submittal floor plan drawings.

9.7 Wall space temperature sensor cabling (from the sensor to the unitary controller) shall have a minimum of four (4) conductors.

9.8 All cabling shall be stranded. "NO" solid conductors will be accepted. All cabling shall be 100% shielded with appropriate drain wire and insulation.

9.9 All cable connections shall be continuous run (including shield). Any junctions must be made in a metal enclosure, connections must be soldered, taped and the metal enclosure must be mechanically attached to the nearest ground. No wire nuts or crimped connections will be accepted. Note location of junction boxes on the as built floor plans. All cabling networking unitary controllers, and other networked equipment, shall be in soldered.

9.10 All shields must be terminated as per manufacturer's recommendation. Shield termination requirements by the manufacturer must be provided with submittals.

9.11 Wireless controllers are not approved unless specifically mentioned in the sequence of operations or noted on plans.

PART 10 – SYSTEM SOFTWARE:

10.1 System software will be the latest version available with upgrades provided for full warranty period and shall be fully licensed to the owner for all network controllers and servers. Refer to WARRANTY section of this specification for additional requirements.

10.2 The BAS shall include trend logging screens accessible from tabs on the home page for building utilities usage.

10.3 System software shall, at a minimum, provide:
- Monitor and supervise all control points.
- Add new points and edit system database.
- Change control setpoints, timing parameters and loop tuning of PID coefficients in all control loops in all control units.
- Enter programmed start/stop schedules.
- View alarm and messages.
- Modify existing control logic (or sequence of operation) in all control units.
- Upload/Download programs, databases, control parameters, etc.
- Modify graphic screens.

10.4 Sequence of operation programming methodology - The application software shall be user programmable. Application programming shall be (1) Line type programming that uses text programming in a language similar to BASIC or FORTRAN, or (2) graphical block programming - The method of programming shall be by manipulation of graphic icon "blocks." Each block represents a subroutine containing the programming necessary to execute the function of the device that the block represents.

10.5 Unitary Control Unit Database Archiving - The host software shall provide capability to upload sequence of operation, database, and other control parameters from each controller. Uploaded programs shall be retained on hard disk for system backup. Programs may be modified using Editor functions and downloaded to individual controllers as desired. Downloading of databases shall not interrupt other multi-tasked functions that are ongoing.

10.6 THIRD PARTY SOFTWARE PACKAGES: The host software shall provide the capacity to run third party software packages for word processing, spreadsheets, or database management programs. Use of third party software shall not suspend operation of background tasks of multi-tasking operating system, such as alarm logging, and report generation.

PART 11 – NETWORK CONTROLLER

11.1 Install the Network Controller in a surface mounted panel, NEMA type 1 enclosures, with a removable hinged door. Provide a flush mounted key lock. All control panels must be painted the same color and identified. The boxes are to be made from 16 gauge material. Panels should not be provided with knockouts.

11.2 Control panels shall be constructed by a UL approved panel manufacturer. The standard used shall be UL508A. All proper labels are to be attached. Panel shall meet arc flash requirements.

11.3 The Network Controller shall be web-based and communicate BACnet IP. It shall issue all time schedules, summer/winter commands, customized trending, holiday scheduling, alarm handling, clock, or other shared commands to all unitary controllers within the building network. If for any reason communications between the unitary(s) and the Network Controller is lost, the unitary(s) shall operate in a stand-alone manner (in day operation) until communications is restored. It shall also operate in the “summer” or “winter” mode as last commanded.

11.4 The Network Controller shall be integrated and interoperable with the facility infrastructure and include user access to all system data locally over the Local Area Network (LAN) / Wide Area Network (WAN) within the building and remotely by a standard Web Browser over the Internet. Any computer connected to the network, utilizing a web browser, and having the proper password.

11.5 The Network Controller shall be a fully user-programmable, supervisory controller. It shall monitor the network of distributed unitary controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Controllers.

11.6 The Network Controller shall have battery back-up to allow a minimum of seven days of operation. The Network Controller shall be composed of one or more independent, stand-alone, microprocessor to manage the network strategies described in Application software section. The network controller shall have ample memory to support its operating system, database, and programming requirements. The operating system of the Network Controller shall manage the input and output communications signals to allow distributed unitary controllers to share real and virtual point information and allow central monitoring and alarms. The database and custom programming routines of the Network Controller shall be editable from a single operator station.

11.7 The Network Controller shall be remotely monitored via the internet. Additionally, it shall include automatic emailing and texting out alarms, gathering alarms, reports and logs, programming and downloading database.

11.8 The Network Controller shall continually check the status of all processor and memory circuits. If a failure is detected, the controller shall:

- Assume a predetermined failure mode.
- Emit an alarm.
- Display card failure identification.

11.9 Under no circumstance shall more than 75% of the total number of sensor and control points be connected through a single Network Controller. Each DDC system component shall provide for the future addition of at least 20% of each type of the number of sensor and control points connected to that component including a minimum of one universal input and one universal output.

PART 12 – UNITARY CONTROLLER

12.1 Unless otherwise specified, each piece of equipment shall have its own Unitary Controller (i.e., heat pump, AHU, terminal unit, etc.). The Unitary Controller for each piece of equipment shall be mounted

on the side of the unit. The Unitary Controller for all other equipment shall be mounted in a panel and properly labeled.

12.2 Each Central Station Air Handler and/or Outside Air Unit shall have its own Unitary Controller mounted where shown on the drawings. If an installation location is not clear, the Contractor shall notify the Engineer for clarification prior to installation.

12.3 Unitary Controllers used in conditioned ambient shall be mounted in dust-proof enclosures, and shall be rated for operation at 32 degrees F to 120 degrees F. All Unitary Controllers shall have an RJ-11 or similar type connection for monitoring or programming access by room or local equipment level with access to any unitary within the network without modification.

12.4 Control panels shall be constructed by a UL approved panel manufacturer. The standard used shall be UL508A. All proper labels are to be attached. Panel shall meet arc flash requirements.

12.5 Unitary Controllers utilized in the network shall have full stand alone capability including time of day and holiday scheduling as well as all energy management functions such as optimal start/stop, duty cycling, etc. The terminal unit Unitary Controllers may be pre-programmed with the project specific sequence of operation as specified for the application. Any re-programming of the electronics shall be performed on location using a portable personal computer with appropriate software or through the Network Controller. The entire unitary data base shall have the capability of being backed up and or downloaded locally.

12.6 All points to have a unique digital input to the BAS system. The use of digital point count expanders is not an acceptable replacement to digital inputs to the unitary controller. The conversion of a single universal input channel to accept up to multiple voltage free contacts such as relay contacts, auxiliary starter contacts, differential pressure switches, etc. IS NOT ACCEPTABLE.

12.7 Unitary Controllers shall communicate via BACnet protocol. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each Unitary Controller that will communicate on the BACnet MS/TP Bus.

12.8 All Unitary Controllers shall be fully application programmable. All control sequences within or programmed into the unitary controller shall be stored in non-volatile memory, which is not dependent upon the presence of a battery shall be retained.

12.9 Unitary Controllers shall have a 10% spare point capacity to be provided for all applications.

12.10 The Unitary Controller for each VAV box shall be mounted on the side of the unit. The unitary controller for all other equipment shall be mounted in a panel and properly labeled. Prior to installation, ensure through coordination with all trades, that appropriate clearances (36” minimum) as required by the N.E.C. are maintained at all control panels, including unitary controllers for VAV terminals, etc.

12.11 After a power failure, the Unitary Controller shall operate the control application using the current setpoints and configuration. Reverting to default or factory setpoints are not acceptable.

PART 13 – SENSORS AND MISCELLANEOUS DEVICES:

13.1 SENSOR RESOLUTION: All temperature sensors shall have a minimum resolution of 1/10th of 1 degree F. (0.1 degree F.) Sensor stability shall be 0.24 degrees over a year period. Space sensors shall be tested and accurate to within 0.75 degrees F. Outside air, water and duct sensors shall be tested and accurate to within 2.0 degrees F.

13.2 SPACE SENSORS AND THERMOSTATS:

- Refer to the drawings for proper type and location.
- All thermostat and sensors shall be provided with temperature indication, unless otherwise noted.
- Programmed set-point shall be locally adjustable limited to 2 degrees above set-point and 2 degrees below set-point for supervised areas.
- Unsupervised areas shall have non-adjustable set-point.
- Generally, thermostats/sensors shall be installed 5'-0" above the finished floor.
- Where thermostats/sensors are to be mounted next to a light switch, install at the same height as the light switch.
- Sensors in hallways, vestibules, stairways, restrooms, and locker rooms shall utilize a stainless steel surface mount temperature sensor installed on an interior wall or partition (2"x4" blank plate). Care must be taken in the installation of these sensors to ensure proper insulation from the wall temperatures in order to properly sense space temperature.
- If there is a question consult engineer prior to rough-in.

13.3 DISCHARGE AIR AND DUCT ROOM RETURN AIR SENSORS: Shall be rigid insertion type. In all applications, care shall be taken to ensure that the sensors are securely mounted as not to allow any vibration and installed in such a manner as to indicate the truest possible temperature.

13.4 LOW PRESSURE TRANSDUCERS: These devises shall be 100% solid state, linear and temperature compensated. Accuracy shall be no less than plus or minus 1% of its full range. Linearity, repeatability, and hysteresis shall be no less that plus or minus 0.1%. All pressure sensors shall utilize output averaging/output clipping to adjust and stabilize any fluctuations in the output. The output of the device shall utilize a 0 - 10 VDC signal. The device shall use a power supply of 24 VAC or VDC. The enclosure 16 gauge steel. For sensing internal static pressure of air handling ducts utilize sensors with a rage of 0 to 5 inches water column. For sensing building static pressures (building compared to atmospheric) utilize a sensor with a range of -0.25 to +0.25 inches water column.

13.5 RELAYS: Relays for starting and stopping fractional horsepower motors shall be rated as follows:

- 1/4 horsepower motors or less use 15 ampere rated relays,
- 1/3 horsepower motors use 20 ampere rated relays,
- 1/2 horsepower motors use 30 ampere rated relays,
- Relays used for pilot duty service shall be rated at a minimum of 10 amperes.
- Provide auxiliary pilot duty relays on motor starters as required for control function.
- Do not install control and status relays in packaged equipment control panel enclosures containing Class 1 starters.

13.6 SMOKE SHUTDOWN: All AHUs, OA units, Heat Pump Units, etc with fans of greater than 2,000 CFM are required to have smoke shutdown safeties as required by the Building Code. These smoke detectors shall have a set of auxiliary contracts wired to a dedicated input of the Unitary to provide status of the smoke detector. All units must be provided with a current sensor to provide fan status for each air handler. For projects with Outside Air (OA) units, any system fire alarm activation shall shutdown all OA units. Coordinate with the Fire Alarm Contractor to ensure a complete, code compliant installation.

13.7 CURRENT SENSING DEVICES: Veris Industries model Hx08 Series and H701 or equal. All current sensors shall be capable of alarming to the BAS for belt losses, pump coupling shear or other mechanical failure on loads.

13.8 DIFFERENTIAL PRESSURE TRANSMITTERS: Provide Rosemount (ITT Bell & Gossett ST-102R) or Johnson Controls Setra DPT 2302-050-V field mounted differential pressure sensor transmitters as indicated on the plans. Range shall be 0-25 psig. Accuracy shall be .025% full span.

PART 14 - VALVES, DAMPERS AND ACTUATORS:

14.1 Unless otherwise specified, valves shall be furnished and sized by the TCC. The valves are to provide the required capacity and the close off rating shall be in excess of the system pressures encountered (minimum 40 psi differential). Proportioning-type valve bodies shall be packed type with throttling type inner valve (quick close plug shall not be acceptable). Proportional type valves to be rated at 125 psi static pressure. Modulating control valves shall be selected within a 3-5 psig pressure drop range. Two position control valves (open/close) shall be line size.

14.2 Dampers for various units requiring field mounting shall be tight closing, "ultra low leakage", opposed blade with side and edge seals. They shall be sized and furnished under this section. Installation of dampers shall be by the sheet metal contractor, coordinated by the TCC. Frames shall be no less than 16 gauge galvanized steel and furnished with mounting holes for duct mounting. Damper blades shall be no less than 14 gauge galvanized steel with maximum blade width of 8 inches. Blades shall be secured to 1/2 inch zinc plated axles and hardware with nylon bearings. Provide thrust bearings at the end of each blade. All dampers shall have end switches to positively prove damper position. No Exceptions!

14.3 All damper and valve actuators shall be fail safe spring return type with sufficient force to operate the dampers or valves under all normal operating conditions. They shall return to the normally open position upon a loss of power. Exceptions to the spring return applications are (1) face and bypass actuators, (2) boiler 3-way loop mixing valves, (2) boiler room seasonal changeover valves. Actuators for fan coil units, terminal units, etc. shall fail in the last position.

14.4 "ALL" Act shall be Belimo and have internal feedback circuitry to provide a positive action to ensure proper positioning of the damper or valve through the entire sequence. Actuators shall have an adjustable starting point to accurately set the range of travel to the output of the controller. All actuators shall also utilize the same input signal (6-9 VDC, 0-010V, 2-10 VDC, 4-20 MA) in order to maintain some consistency in the control application. Analog actuation is 6-9 VDC, 0-010V, 2-10 VDC or 4-20 MA, floating point control with 2 digital outputs is NOT approved as analog actuation.

14.5 Actuators may be factory installed. If not, factory installed, they shall be installed as per instructions by the terminal equipment manufacturer.

14.6 Locations mounted above ceiling shall be marked on ceiling grid.

14.7 Install damper motors on the outside of the duct in warm areas where possible, not in air stream or locations.

PART 15 – GRAPHICS SCREENS AND TRENDS:

15.1 All graphics screens shall be submitted for review by Engineer. Provide the following animated, color graphics screens minimally:

15.2 Entire floor plan home screen with OAT, Time, and Date displays.

- Floor plan showing major zones,
- Click major zone displays enlarged floor plan of the zone showing individual heat pump zones & numbers. Include link to respective mechanical room.
- Click individual zone shows heat pump graphic. Display all data points from points list, occ/unocc schedule and setpoints, VAV cfm and setpoint, OAT, Time, and Date.

15.3 Graphics to include floor plans with room numbers (as-built room numbers) and thermostat locations, links to flow diagrams for heat pumps, zone dampers, hydronic loop systems, outside air systems,

domestic hot water, and lighting controls.

15.4 All new graphics shall match the existing system graphics, unless noted otherwise.

15.5 The graphical programming software shall allow for interactive mouse-driven placement of block icons on the graphic screen and connection of block inputs to block outputs by means of drawing lines to form a graphic logic diagram. The user shall not have to manually input text to assign block input/output interconnections. Blocks shall allow entry of adjustable settings and parameters via pop-up windows.

15.6 The clarity of sequence shall be such that the user has the ability to verify that the system programming meets the specs without having to learn or interpret a manufacturer's unique programming language. Provide a means for testing and/or debugging the control programs off-line (not communicating with control units) using operator entered values for physical inputs and time. Provide a means for testing and/or debugging the control programs on-line (communicating with control units), showing actual physical inputs land all block outputs in real time.

15.7 Provide a utility that shall allow the graphic logic diagrams to be directly compiled into application programs. Logic diagrams shall be viewable either off-line, or on-line with real-time output values.

15.8 All graphic software shall be in the html web browser format and support multiple simultaneous screens to be opened and resizable in a "Windows" type environment. All functions, except text entry, shall be executable with a mouse. Graphic software shall provide for multitasking such that third party programs can be used while the Operator Workstation Software is on-line. Provide the ability to alarm graphically even when operator is in another software package. The software shall allow for Owner to create user defined, color graphic displays of geographic maps, building plans, floor plans, and mechanical and electrical system schematics.

15.9 The contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g. fans, coils, filters, dampers, etc.), mechanical system components (e.g., pumps, heat pumps, etc.), complete mechanical systems (e.g. VAV, etc.) and electrical symbols.

15.10 The graphic development package shall use a mouse or similar pointing device to allow the user to perform the following:

- Define symbols
- Position items on graphic screens
- Attach physical or virtual points to a graphic
- Define background screens
- Define connecting lines and curves
- Locate, orient and size descriptive text
- Define and display colors for all elements
- Establish correlation between symbols or text and associated system points or other displays.
- Create hot spots or link triggers to other graphic displays or other functions in the software

15.11 The TCC shall including programming of 25 point trends as directed by the Engineer. These can be requested at any time during the project including the warranty period. Trend "change of state" for digital inputs. Trend analog points in 30 minute increments. Maintain trend history for 30 days.

SEQUENCE OF OPERATIONS

PART 16 – VARIABLE AIR VOLUME (VAV) BOX:

16.1 The individual room temperature will be maintained by a room sensor and VAV reheat box for that area. VAV box shall have a fully programmable unitary controller capable of providing required sequence. Provide with discharge air sensor.

16.2 Occupied Mode: When occupancy sensor detects room is vacant, box shall be in STANDBY at zero CFM until air is required to maintain standby temperatures. When room is occupied and no heating or cooling is required, the VAV box airflow shall be at minimum. When room temperature is below setpoint, the reheat valve shall modulate open. If additional heating is required, airflow shall be modulated to maximum airflow setpoint. When hot water is unavailable, this shall be communicated to all VAV controllers so that airflow is not increased to satisfy heating load. When the room temperature is above setpoint, VAV box damper shall be modulated from minimum airflow setpoint to maximum cooling airflow setpoint to maintain temperature.

16.3 Occupied Mode: When building is indexed to unoccupied, VAV box damper and valve shall be full closed. When AHU starts in unoccupied or morning warm-up mode, VAV box shall be full open and modulate reheat coil to maintain 110°F discharge. If space temperature setpoint is reached during this time, valve and damper shall be modulated closed. Programmed setpoints are as follows:

16.3.1 Heating mode: Adjustable 69-73 degrees F.

16.3.2 Cooling mode: Adjustable 73-77 degrees F.

16.4 When cooling is required, the variable air inlet damper shall modulate between the minimum and maximum air flow rates to maintain room air temperature setpoint. The 2-way hot water control valve shall be closed.

16.5 Primary air CFM shall be monitored by the DDC control system.

16.6 Discharge air temperature shall be monitored by the DDC control system.

16.7 Morning Warmup Mode: When the AHU discharge is warmer that the space temperature, the VAV shall reverse action on the air damper control. If the space temperature has satisfied, the damper shall modulate to the closed position. If the space temperature is below setpoint, the damper shall open and the hot water control valve shall modulate as required to maintain setpoint.

PART 17 – PACKAGED ROOFTOP UNITS (RTU-1):

17.1 Supply Air Temperature Control: During occupied mode the unit shall maintain space temperature setpoint using DX compressor, gas heat and integral controls. A thermostat provided by control contractor shall interlock with unit as required.

17.1.1 If outside air conditions are acceptable the economizer controls shall be used to maintain space setpoint.

17.1.2 The supply fan shall modulate on/off with compressor operation.

17.1.3 The outside air dampers shall be interlocked to the compressors to open in minimum position when compressors are operational.

17.2 Units shall be off during unoccupied mode, unless space temperature is 10°F (adj.) below setback temperature. Unit shall automatically switch into occupied mode until space temperature is meet. The outside air dampers shall be closed during this period.

PART 18 – SPLIT-SYSTEMS:

18.1 Provide all necessary wiring, conduit, etc. as required to interlock the controller, indoor air handling unit, and outdoor condensing unit as required to maintain space setpoint. Outdoor condensing unit shall be interlocked so that it is unable to operate when indoor fan is not running.

18.2 Provide DDC room temperature sensor and all required interlock wiring.

PART 19 – BUILDING EXHAUST FANS (EF-1):

19.1 The building exhaust fans shall operate continuously in the occupied mode. In the unoccupied building mode fans shall be off.

19.2 Fan status shall be monitored using a current sensor.

PART 20 – Dishwasher EXHAUST FANS:

20.1 Interlock the fan to operate when the dishwasher is running.

20.2 Fan status shall be monitored using a current sensor.

PART 21 – ELECTRIC HEATERS (EH-1):

21.1 When the outdoor air temperature is 60F (adj.) or below, the heater shall be enabled. The unit is provided with an integral thermostat, control the space temperature to 65°F. TCC to provide a relay to disable the heater when the MCP is indexed to summer mode. The TCC shall provide a wall mounted sensor to allow for monitoring of space temperature and provide low temperature alarm.

END OF CONTROL – DIRECT DIGITAL (WEB BASED)

SECTION 26 00 10 - GENERAL REQUIREMENTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. The Instructions to Bidders, General and Special Conditions, and all other contract documents shall apply to the Contractor's work as well as to each Sub Contractor's work. Each Contractor is directed to familiarize themself in detail with all documents pertinent to this Contract. In case of conflict between these General Provisions and the General and/or Special Conditions, the affected Contractor shall contact the Engineer for clarification and final determination.

C. Each Contractor shall be governed by any alternates, unit prices and Addenda or other contract documents insofar as they may affect their part of the work.

1.2 SUMMARY

A. Section Includes general requirements applicable to work specified in Divisions 26, 27, and 28.

B. The work included in this division consists of the furnishing of all labor, equipment, transportation, supplies, material, and appurtenances and performing all operations necessary for the satisfactory installation of complete and operating Electrical Systems indicated on the drawings and/or specified herein.

C. Any materials, labor, equipment, or services not mentioned specifically herein which may be necessary to complete or perfect any part of the Electrical Systems in a substantial manner, in compliance with the requirements stated, implied, or intended in the drawings and specifications, shall be included as part of this Contract. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in their bid, and that they will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

D. It is not the intent of this section of the specifications (or the remainder of the contract documents) to make any specific Contractor, other than the Contractor holding the prime contract, responsible to the Owner, Architect and Engineer. All transactions such as submittal of shop drawings, claims for extra costs, requests for equipment or materials substitution, shall be done through the Contractor to the Architect (if applicable), then to the Engineer.

E. This section of the Specifications or the arrangement of the contract documents shall not be construed as an attempt to arbitrarily assign responsibility for work, material, equipment or services to a particular trade Contractor or Sub-Contractor. Unless stated otherwise, the subdivision and assignment of work under the various sections shall be the responsibility of the Contractor holding the prime contract.

F. Any reference within these specifications to a specific entity, i.e., "Electrical Contractor" is not to be construed as an provide to limit or define the scope of work for that entity or assign work to a specific trade or contracting entity. Such assignments of responsibility are the responsibility of the Contractor holding the prime contract, unless otherwise provided herein.

G. In each of the specifications and drawings referred to herein, consider the advisory provisions to be mandatory, as though the word, "shall" had been substituted for "should" wherever it appears.

H. Intent and Interpretation

1. It is the intent of these specifications and all associated drawings that the Contractor provide finished work, tested, and ready for operation. Wherever the word "provide" is used, it shall mean "furnish and install complete, tested and ready for operation."
2. Minor details not usually shown or specified, but necessary for the proper installation and operation, shall be included in the work, the same as if herein specified or shown.
3. It is the intention of the Contract Documents to call for a complete and operational system, including all components, accessories, finish work, etc. as necessary for trouble free operation, tested and ready for operation. Anything that may be required, implied, or inferred by the Contract Documents shall be provided and included as part of the Bid.
4. All Contractors and Vendors providing a bid for this project shall review the Plans and Specifications and determine any modifications and/or adjustments necessary relative to the proposed equipment and materials with specific manufacturer's installation requirements. Include in the bid any necessary installation methods, features, options, accessories, etc. necessary to install the proposed equipment and materials, regardless of whether used as basis of design or being offered as a substitution in accordance with the specific manufacturer's installation requirements whether specifically detailed or not within the Plans and Specifications.
5. The Bidder/Proposer shall completely review the Contract Documents. Any interpretation as to design intent or scope shall be provided by the Engineer/ Architect. Should an interpretation be required, the Bidder/Proposer shall request a clarification not less than ten days prior to the submission of the proposal so that the condition may be clarified by Addendum. In the event of any conflict, discrepancy, or inconsistency develops; the interpretation of the Engineer shall be final.
6. The Contractor shall give written notice of any materials or apparatus believed inadequate or unsuitable; in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction; and any necessary items of work omitted a minimum of ten days prior to bid. In the absence of such written notice and by the act of submitting a bid, it shall be understood that the Contractor has included the cost of all required items in the bid, and that will be responsible for the approved satisfactory functioning of the entire system without extra compensations.

I. Drawings and Specifications

1. The drawings are diagrammatic only and indicate the general arrangement of the systems and are to be followed insofar as possible. If deviations from the layouts are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted in writing to the Engineer for approval before proceeding with the work. The Contract Drawings are not intended to show every vertical or horizontal offset which may be necessary to complete the systems. Contractors shall, however, anticipate that additional offsets may be required and submit their bid accordingly.
2. The drawings and specifications are intended to supplement each other. No Contractor, bidder, proposer, or supplier shall take advantage of conflict between them, or between parts of either, but should this condition exist, the Contractor or supplier shall request a clarification of the condition at least ten days prior to the submission of bids so that the condition may be clarified by Addendum. In the event that such a condition arises after work is started, the interpretation of the Engineer shall be the determining factor. In all

instances, unless modified in writing and agreed upon by all parties thereto, the Contract to accomplish the work shall be binding on the affected Contractor.

3. The drawings and specifications shall be considered to be cooperative and complimentary and anything appearing in the specifications which may not be indicated on the drawings or conversely, shall be considered as part of the Contract and must be executed the same as though indicated by both.
4. This Contractor shall make all their own measurements in the field and shall be responsible for correct fitting. They shall coordinate this work with all other branches of work in such a manner as to cause a minimum of conflict or delay.
5. The Engineer shall reserve the right to make minor adjustments in location of conduit, fixtures, outlets, switches, etc., where they consider such adjustments desirable in the interest of concealing work or presenting a better appearance.
6. Each Contractor shall evaluate ceiling heights called for on Architectural Plans and ensure that these heights may be maintained after all mechanical and electrical equipment is installed. Where the location of Electrical equipment may interfere with ceiling heights, the Contractor shall call this to the attention of the Engineer in writing prior to making the installation. Any such changes shall be anticipated and requested sufficiently in advance so as to not cause extra work on the part of the Contractor or unduly delay the work.
7. Should overlap of work between the various trades become evident, this shall be called to the attention of the Engineer. In such an event, neither trade shall assume that he is to be relieved of the work which is specified under his branch until instructions in writing are received from the Engineer.
8. The Electrical drawings are intended to show the approximate location of equipment, materials, etc. Dimensions given in figures on the drawings shall take precedence over scaled dimensions and all dimensions whether given in figures or scaled shall be verified in the field. In case of conflict between small- and large-scale drawings, the larger scale drawings shall take precedence.
9. The Electrical Contractor and their Sub-Contractors shall review all drawings in detail as they may relate to his work (structural, architectural, site survey, mechanical, etc.). Review all drawings for general coordination of work, responsibilities, ceiling clearances, wall penetration points, chase access, fixture elevations, etc. Make any pertinent coordination or apparent conflict comments to the Engineers at least ten days prior to bids, for issuance of clarification by written addendum.
10. Where on any of the drawings a portion of the work is drawn out and the remainder is indicated in outline, or not indicated at all, the parts drawn out shall apply to all other like portions of the work. Where ornament or other detail is indicated by starting only, such detail shall be continued throughout the courses or parts in which it occurs and shall also apply to all other similar parts of the work, unless otherwise indicated.

1.3 COST BREAKDOWN AND PAY APPLICATIONS

A. Within thirty days after acceptance of the Contract, each Contractor is required to furnish to the Engineer one copy of a detailed cost breakdown on each respective area of work. These cost breakdowns shall be made on forms provided or approved by the Engineer or Architect. Payments will not be made until satisfactory cost breakdowns are submitted. Refer to Division 00 and 01 specification sections for additional requirements.

B. In addition to cost breakdowns by specification section, the following shall also be provided: Material and labor shall be listed separately. These items are in addition to items listed in Division 01 specifications. Pay special attention to required withholding percentages for startup, testing, documentation, acceptance, owner training, etc. The breakdown shall be minimally as follows:

1. Permitting
2. Mobilization

3. Electrical Submittals
4. Electrical Coordination Drawings
5. Temporary Power
6. Interior Lighting Materials & Labor
7. Exterior Lighting Materials & Labor
8. Lighting Controls Materials & Labor
9. Lighting and Lighting Controls Startup, Testing, & Verification (equal to 2.5% of Equipment Value)
10. Electrical Distribution Equipment Materials & Labor
11. Electrical Distribution Equipment Startup, Testing, & Verification (equal to 2.5% of Equipment Value)
12. Electrical Distribution Equipment Power System Study & Field Adjusting
13. Feeders Materials & Labor
14. Branch Circuiting Materials & Labor
15. Service Grounding Materials & Labor
16. Surge Suppression Materials & Labor
17. Electrical Devices Materials & Labor
18. Cable Trays Materials & Labor
19. Underground Duct Banks Materials & Labor
20. Fire Alarm Materials & Labor
21. Fire Alarm System Startup, Testing, & Verification (equal to 5% of Equipment Value)
22. Low-Voltage Data/Voice Cabling Materials & Labor
23. Low-voltage Data/Voice Equipment Materials & Labor
24. Audio/Video Equipment and Cabling Materials & Labor
25. Access Controls Equipment and Cabling Materials & Labor
26. Security Equipment and Cabling Materials & Labor
27. Video Surveillance Equipment and Cabling Materials & Labor
28. Low Voltage Systems Startup, Testing, & Verification (equal to 5% of Equipment Value)
29. Owner Training
30. Punchlist
31. As-Built/Record Drawings
32. O&M Manuals
33. Warranty
34. Demobilization

1.4 REFERENCES

A. Abbreviations and Acronyms

1. A, AMP: Ampere
2. ADA: Americans with Disabilities Act.
3. AFF: Above Finished Floor
4. AFG: Above Finished Grade
5. AHJ: Authority Having Jurisdiction
6. AHU: Air Handling Unit
7. AIC: Amps Interrupting Capacity
8. ANSI: American National Standards Institute.
9. ASA: American Standards Association.
10. ASTM: American Society for Testing Materials.
11. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.
12. ATS: Automatic Transfer Switch
13. A/V: Audio/Visual
14. AWG: American Wire Gauge
15. BAS: Building Automation System

16. BFG: Below Finished Grade
17. BICSI: Building Industry Consulting Services International
18. C: Conduit
19. CB: Circuit Breaker
20. CFCI: Contractor Furnished, Contractor Installed
21. CFOI: Contractor Furnished, Owner Installed
22. CKT: Circuit
23. CLG: Ceiling
24. CT: Current Transformer
25. CM: Construction Manager
26. DDC: Direct Digital Building Controls
27. DOAS: Dedicated Outdoor Air System
28. DWG: Drawing
29. EC: Electrical Contractor
30. ELEV: Elevator
31. EM: Emergency
32. EPO: Emergency Power Off
33. FA: Fire Alarm
34. FAA: Fire Alarm Annunciator
35. FACP: Fire Alarm Control Panel
36. FCC: United States Federal Communications Commission
37. FFE: Finished Floor Elevation
38. FLA: Full Load Amps
39. G, GND: Ground
40. GFCI: Ground Fault Circuit Interrupter
41. GC: General Contractor
42. HOA: Hands Off Auto
43. HP: Horsepower
44. IDF: Intermediate Distribution Frame
45. IECC: International Energy Conservation Code
46. ISO: International Standards Organization.
47. IT: Information Technology
48. KVA: Kilovolt-Amperes
49. KW: Kilowatt
50. KWH: Kilowatts Hours
51. LRA: Locked Rotor Amps
52. LTG: Lighting
53. MC: Mechanical Contractor
54. MCA: Minimum Circuit Ampacity
55. MCB: Main Circuit Breaker
56. MDF: Main Distribution Frame
57. MDP: Main Distribution Panel
58. MLO: Main Lugs Only
59. MOCP: Maximum Overcurrent Protection
60. MSB: Main Switchboard
61. N/A: Not Applicable
62. NEC: National Electrical Code
63. NECA: Standards for Installation.
64. NEMA: National Electrical Manufacturers Association.
65. NESC: National Electrical Safety Code.
66. NFPA: National Fire Protection Association.
67. NIC: Not in Contract
68. NRTL: Nationally Recognized Testing Laboratory
69. NTS: Not to Scale
70. N/A: Not Applicable

71. OFCI: Owner Furnished, Contractor Installed
72. OFOI: Owner Furnished, Owner Installed
73. OSHA: Office of Safety and Health Administration.
74. P: Pole, Poles
75. PC: Plumbing Contractor
76. PIR: Passive Infrared
77. RFI: Request for Information
78. RIO: Rough-in Only
79. RM: Room
80. SPD: Surge Protection Device
81. SS: Stainless Steel
82. SWBD: Switchboard
83. TIA: Telecommunications Industry Association
84. TYP: Typical
85. UL: Underwriters Laboratories, Inc.
86. UON or UNO: Unless otherwise noted.
87. UG: Underground
88. V: Volt, Volts
89. VFD: Variable Frequency Drive
90. W: Watts
91. WG: Wire Guard
92. WP: Weather Proof
93. XFMR: Transformer

B. Definitions

1. Architect: The Architect of Record for the project, if applicable.
2. Basis of Design (BOD): Documentation of primary thought processes and assumptions behind design decisions made to meet design intent. Describes systems, components, conditions, and methods chosen to meet intent.
3. Bidder/Proposer: Any person, agency or entity submitting a proposal to any person, agency, or entity for any part of the work required under this contract.
4. Contract Documents: All documents pertinent to the quality and quantity of work to be performed on this project. Includes, but not limited to: Plans, Specifications, Instructions to Bidders, General and Special Conditions, Addenda, Alternates, Lists of Materials, Lists of Sub-Contractors, Unit Prices, Shop Drawings, Field Orders, Change Orders, Cost Breakdowns, Schedules of Value, Periodical Payment Requests, Construction Manager's Assignments, Architect's Supplemental Instructions, Construction Contract with Owner, etc.
5. Contractor: Any Contractor whether bidding, proposing, or working independently or under the supervision of a General Contractor, Prime Contractor, or Construction Manager and who installs any type of Electrical Work as specified in the Contract Documents.
6. Electrical Contractor: Any Contractor whether bidding or working independently or under the supervision of the entity holding the Prime Contract and who installs any type of Electrical work, such as: power, lighting, television, telecommunications, data, fiber optic, intercom, fire detection and alarm, security, video, underground or overhead electrical, etc.
7. Electrical Sub-Contractor: Each or any Contractor contracted to, or employed by, the Electrical Contractor for any work required by the Electrical Contractor.
8. Engineer: The Consulting Mechanical-Electrical Engineer consulting to the Owner, Architect, or Other, etc.
9. Indicated: Listed in the Specifications, shown on the Plans or Addenda thereto.
10. Install: Install equipment furnished by others in complete working order.
11. Installer: Contractor or another entity engaged by Contractor as an employee, subcontractor, or sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

12. Furnish: Deliver to the site in good condition and turn over to the Contractor who is to install.
13. Prime Contractor: The Contractor who has been engaged by the Owner in a contractual relationship to accomplish the work.
14. Project: All of the work required under this Contract.
15. Provide: Furnish and install complete, tested, and ready for operation.
16. Start-Up: The activities where systems or equipment are initially tested and operated. Start-up is completed prior to functional testing.
17. Typical: Where indicated repeat this work, method or means each time the same or similar condition occurs whether indicated or not.
18. Vendor: Supplier of equipment.

C. Reference Standards: Contractor is responsible for knowledge and application of current versions of all applicable standards and codes. Contractor shall adhere to the most recent revisions or version adopted by the Authorities Having Jurisdiction, including all relevant changes or addenda at the time of installation.

1. IEEE – Institute of Electrical and Electronics Engineers.
   a. IEEE C2, National Electrical Safety Code
2. NECA – National Electrical Contractors Association.
   a. NECA 1, Standard for Good Workmanship in Electrical Construction
3. NFPA - National Fire Protection Association.
   a. NFPA 70, National Electrical Code (NEC)
4. OSHA - The Occupational Safety and Health Act

1.5 COORDINATION

A. Utility Company Requirements

1. Contact the utility company for specifics on construction of pads, conduit, etc., prior to bidding the work and determine all their requirements. All work shall be in accordance with their standards.
2. Each contractor, prior to bidding the work, is to contact the utility companies (electric and telecommunications) and determine the exact points of extension of all underground services in the field with a representative of each utility company. Also, obtain construction details on manholes, transformer pads, pedestal stub-ups, etc., from each utility company as applicable. Extension points indicated on the plans are approximate and are given for the bidder's information only.
3. The Contractor shall provide the local utility company with a drawing produced by a licensed Land Surveyor or a licensed Engineer and acceptable to the utility that locates the centerline of the service and connection point. Coordinate further requirements with utility company.
4. The Contractor is responsible for all fees, permit costs, etc., from the electrical utility, data, telephone, and cable TV companies. This includes any cost associated with the underground electrical service extension.

B. Coordination with Existing Utilities and Structures

1. The locations of all piping, conduits, cables, utilities, and manholes existing, or otherwise, that are present within the contract construction site, shall be subject to continuous uninterrupted maintenance with no exception unless the Owner of the utility grants permission for temporary interruption.

2. Known utilities and structures as available to the Engineer are shown on the drawings. However, it is additionally required that, prior to any excavation being performed, each Contractor ascertain and mark all utilities or lines that would be endangered by the excavation. Contractor shall bear costs of repairing damaged utilities.
3. If utilities or structures are installed within the construction project boundary, the Contractor shall first probe and make every effort to locate the lines prior to excavating in the respective area.
4. Cutting into existing utilities and services shall be done in coordination with and as designated by the Owner of the utility. The Contractor shall work continuously to restore service(s) upon deliberate or accidental interruption, providing premium time and materials as needed without extra claim to the Owner.
5. The Contractor shall repair to the satisfaction of the Engineer any surface or subsurface improvements damaged during the course of the work unless such improvement is shown to be abandoned or removed.
6. Machine excavation shall not be permitted within ten feet of existing gas or fuel lines. Hand excavate only in these areas, in accord with utility company, agency or other applicable laws, standards or regulations.
7. Protect all new or existing lines from damage by traffic, etc. during construction.
8. Protect existing trees, indicated to remain with fencing or other approved method. Hold all new subsurface lines outside the drip line of trees, offsetting as necessary to protect root structures. Refer to planting or landscaping plans, or in their absence, consult with the Architect.

C. Interruption of Existing Services: In general, and to the extent possible, perform all work without interruption of the existing facilities' operations. Do not interrupt services to facilities occupied by Owner or others unless permitted under the following conditions:

1. Notify the Owner, Architect, and Engineer no fewer than seven days in advance of proposed interruption of service.
2. Provide the exact time the interruption will occur and the length of the interruption.
3. Do not proceed with interruption of service without written permission from Owner, Architect, and Engineer.
4. Failure to comply with this requirement may result in complete work stoppage by the Contractors involved until a complete schedule of interruptions can be developed.
5. Contractor will not be entitled to additional compensation due to work stoppage mandated by unscheduled interruption.
6. Coordinate interruptions with systems impacted by outages including but not limited to the following:
   a. Emergency Lighting
   b. Elevators
   c. Fire Alarm Systems
7. Whenever utilities are interrupted, either deliberately or accidentally, the Contractor shall work continuously to restore the service. The Contractor shall provide tools, materials, skilled journeymen of their own and other trades as necessary, premium time as needed and coordination with all applicable utilities, including payment of utility company charges (if any), all without requests for extra compensation to the Owner, except where otherwise provided for in the contract for the work.

D. Coordination Between Trades

1. The Contractor is expressly directed to read the General Conditions and all detailed sections of these specifications for all other trades and to study all drawings applicable to their work, including Architectural, Mechanical, Structural, and other pertinent Drawings, to the end that complete coordination between trades will be affected.

2. The Contractor is responsible for the correct location of all rough-in and connections at every piece of equipment. Work not correctly located shall be relocated at the Contractor's expense.
3. It shall be the responsibility of each Contractor to leave the necessary room for other trades. No extra compensation or time will be allowed to cover the cost of removing fixtures, devices, conduit, ducts, etc. or equipment found encroaching on space required by others.
4. Where any work is to be installed in close proximity to, or will interfere with work of other trades, each shall cooperate in working out space conditions to make a satisfactory adjustment. If directed by the Engineer, the Contractor shall prepare composite working drawings and sections at a suitable scale not less than ¼ inch = 1 Foot, clearly indicating how his work is to be installed in relation to the work of other trades, or so as not to cause any interference with work of other trades. The Contractor shall make the necessary changes in his work to correct the condition without extra charge.
5. The Contractor shall furnish to other trades, as required, all necessary templates, patterns, setting plans, and shop details for the proper installation of work and for the purpose of coordinating adjacent work.

E. Temporary Services

1. The Contractor shall arrange for temporary electrical and other services required to accomplish the work. In the absence of other provisions in the contract, the Contractor shall provide for temporary services of all types, including the cost of connections, utility company fees, construction, removal, etc., in their bid.
2. All temporary services shall be removed by Contractor prior to acceptance of work.

F. Temporary Use of Equipment

1. The permanent electrical equipment, when installed, may be used for temporary services, subject to an agreement among the Contractors involved, the Owner, and with the consent of the Engineer. Should the permanent systems be used for this purpose, each Contractor shall pay for all temporary connections required and any replacements required due to damage without additional cost to the Owner, leaving the equipment and installation in "as new" condition. The Contractor may be required to bear utility costs, user fees, etc.
2. Permission to use the permanent equipment does not relieve the Contractors who utilize this equipment from the responsibility for any damages to the building construction and/or equipment which might result from its use.

G. Preinstallation Conference

1. Conduct a preinstallation conference at project site before each construction activity when required by other Sections and when required for coordination with other construction.
2. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect and Engineer of scheduled meeting dates.
3. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including any possible conflicts, requirements, limitations, and coordination with other work.
4. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
5. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
6. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date

1.6 SUBMITTALS

A. Review of submittals by the Engineer applies only to conformance with the design intent of the project and general compliance with the information given in the contract documents. In all cases, the installing Contractor alone shall be responsible for furnishing the proper quantity of equipment and/or materials required, for seeing that all equipment fits the available space in a satisfactory manner and that piping, electrical and all other connections are suitably located.

B. The Engineer's review of submittals, schedules or other required submittal data shall not relieve the Contractor from responsibility for the adaptability of the equipment or materials to the project, compliance with applicable codes, rules, regulations, information that pertains to fabrication and installation, dimensions and quantities, electrical characteristics, and coordination of the work with all other trades involved in this project.

C. If a submittal deviates from the drawings or specifications because of Contractor’s standard practice, approved substitution request, or any other reason, the submittal shall notify the designer of the deviation.

D. Prior to the start of work the contractor shall submit the following. Work shall not proceed without the Engineer’s and Owner’s completed review of the submitted items.

E. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Clearly and precisely mark red notations and yellow highlights on the submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Rated capacities, operating characteristics, and electrical characteristics,
    i. Wiring diagrams that show factory-installed wiring and interface points.
    j. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

4. Format and Organization: submit bookmarked electronic PDF files complying with the following:
    a. Cover: Clearly display the following information: Owner name, Project name, Submittal name, project submittal number, Contractor name and contact information, and applicable specification section numbers.
    b. Table of Contents: Include a TOC that lists materials by section number, with a brief product description, manufacturer, and part number, and list the submittal page number per product
    c. Product Information

F. Product Schedules: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.

G. Shop Drawings: Prepare Project-specific information, drawn accurately to scale.

1. Shop Drawings that are reproductions of the Contract Documents are not permitted and will be rejected.
2. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
    b. Mounting Details
    c. Wiring diagrams and installation details
    d. Identification of products.
    e. Schedules.
    f. Compliance with specified standards.
    g. Notation of coordination requirements.
    h. Notation of dimensions established by field measurement.
    i. Seal and signature of professional engineer if specified.

H. Coordination Drawings:

1. Detailed electronic coordination drawings shall be required for this project. The Engineer and the Engineer's Construction Administrator shall closely monitor progress and quality of the preparation of the electronic coordination drawings and may withhold pay requests as deemed appropriate.
2. Coordination Drawings shall be provided on this project by each Trade. Drawings shall be 30x42 sheet size and shall be at ¼-inch scale and shall match the drawing setup as included in the Architectural Drawings. Drawings shall be prepared in electronic format utilizing AutoCad software. The Architect and Engineer will supply electronic drawings files of the Contract Documents upon the Contractor's request and release.
3. The basis for the Coordination Drawings shall be the sheet metal ductwork fabrication shop drawings, all electrical feeder conduits, groupings of branch circuit conduits, other conduits 2" and larger, and pneumatic tube system piping and components in ceiling spaces. These drawings shall indicate all ductwork as double lined with bottom elevations noted. The Coordination Drawings shall indicate:
    a. Systems above ceilings in finished areas,
    b. Systems supported from the structure in finished areas without ceilings,
    c. Systems in the mechanical rooms, and
    d. All wall, roof, floor penetrations.
4. The sheet metal fabrication shop drawings shall be completed in a timely manner so as not to conflict with construction schedule and phasing plan. At the Prime Contractor's discretion, these drawings shall be completed in phases to correspond with the project construction work sequencing. The Mechanical Contractor shall furnish an electronic copy of these ductwork shop drawings to all other Trades, specifically the Fire Protection and Electrical and other Contractors as requested by the Prime Contractor for the purpose of including other trades work on the Coordination Drawings.
5. Pre-Coordination Meetings with all necessary trades shall occur. During these meetings, the Contractors shall discuss locations/elevations where piping, conduits, cable path, etc. will be installed with respect to the sheet metal fabrication drawings and other trades. The sheet metal ductwork and gravity piping systems shall be given the first priority. Within 30 days of the meeting, each Trade shall provide the Mechanical Contractor electronic

drawings of all of their systems (with elevation noted), coordinated with the ductwork and other trades for them to incorporate into the Coordination Drawings. Coordination Meetings shall then occur so that all conflicts can be resolved between Trades. All conflicts shall be resolved between all Trades at these Coordination Meetings and the Mechanical Contractor shall then amend the Drawings to include the Final Coordinated Work.

6. It is realized that not all systems can be completely detailed. The coordination drawings shall include the following at a minimum:
   a. All supply/return/exhaust ductwork.
   b. All above slab sanitary and roof drainage piping.
   c. HVAC, fire protection and domestic water piping which are 2” in size and greater, excluding insulation.
   d. Gas mains.
   e. Electrical conduits which are 1.5” in size and greater.
   f. J-hook and cable tray cabling paths
   g. Groupings of smaller piping/conduits hung on a common hanger.
   h. All wall, roof, floor penetrations.
   i. Light fixtures.
7. After completion of the Final Coordination Drawings, a Final Review with all Trades shall occur to provide any final comments and approval by all Trades. Other interim coordination meeting will be required to ensure successful coordination drawings. Any additional coordination items will be updated by the Mechanical Contractor. The Final Approved Coordination Drawings shall be distributed electronically (on CD) to each Trade by the Mechanical Contractor. The Mechanical Contractor shall also furnish a complete 30x42 paper set of drawings to the jobsite main office and shall utilize them for updates of field conditions/deviations that occur during construction. Final Approved Coordination Drawings shall also be distributed to the Construction Manager, Owner, Architect and Engineer for their Records. This process shall be completed prior to starting any work.
8. Each Contractor shall ensure that any deviations from the Coordination Drawings are recorded as they occur, in red erasable pencil on record drawings kept at the jobsite. Upon completion of a particular phase, the Mechanical Contractor shall incorporate all field deviations into the Coordination Drawings to be utilized as Record Drawings. The Engineer shall review the Record Documents from time to time to ensure compliance with this specification. Compliance shall be a contingency of final payment. Also, pay particular attention to Deviations in the Control Systems and all exterior utilities. Keep information in a set of drawings set aside at the job site especially for this purpose. The Record Drawings shall be distributed electronically (on CD) to the Construction Manager, Owner, Architect and Engineer for their Records.
9. The Mechanical Contractor is responsible to the Prime Contractor for the shop drawing layout of the following rooms and details:
   a. Concrete pads and foundations
   b. Equipment room layouts with actual equipment
   c. Roof layouts
   d. Trench locations and sizes
   e. Dimensioned floor drain locations
   f. Congested areas above ceilings adjacent to mechanical and electrical rooms
   g. Dimensioned ductwork shop drawings
10. The Electrical Contractor is responsible to the General Contractor for the shop drawing layout of the following rooms and details:
   a. Concrete pads and foundations
   b. Equipment room layouts with actual equipment
   c. Routes of feeder conduits and all other conduits 1.5” and larger
   d. J-hook and cable tray cabling paths
   e. Trench locations and sizes
   f. Congested areas above ceilings adjacent to mechanical and electrical rooms
   g. Refer to Part 41 for additional requirements.

h. Light fixture locations
i. Exact layouts of all work in open ceiling areas

I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Architects and Owners, and other information specified.

J. Closeout Submittals

1. Upon substantial completion of the project, provide a minimum of three bound copies with complex index and tabs to locate each item described below along with digital copy in PDF format on USB storage media.
2. As-Built Record Documentation
   a. The Contractor shall insure that any deviations from the design are being recorded daily, as necessary, on record drawings being maintained by the Contractor. Dimensions from fixed, visible permanent lines or landmarks shown in vertical and horizontal ways shall be utilized. Compliance shall be a requirement for final payment. Pay particular attention to the location of underfloor or underground exterior in-contract or utility-owned or leased service lines, main switches, and other appurtenances important to the maintenance and safety of the Electrical System. Deliver these record drawings to the Engineer as a system is completed, within ten days of the mark-up and/or while the accuracy of the mark-ups can be verified visually. Monthly payment may be withheld if the requirement is not complied with.
   b. All underground utilities/piping installed as part of this project shall be surveyed by a land surveyor licensed in the State where the Work is being performed. This shall include underground electrical primary, communications, and structures. The survey shall include actual duct bank depths to top of conduit every 100 feet in length. The survey shall also include benchmarks dimensions relative to above grade, fixed structures. The survey shall be furnished on electronic storage media in AutoCad ".dwg" format and ".pdf" format. The survey information shall be included in the closeout documentation.
   c. Refer to additional record drawing requirements within the general conditions and other sections of these specifications.

3. Start-Up and System Testing Certificates
   a. Provide reports from all required testing to indicate procedures followed and complete results of all tests. Provide reports on manufacturer's standard forms for all equipment and system tests. Testing reports shall indicate applicable NEC, NFPA, UL, NETA, and/or ANSI standards.
4. Operation and Maintenance Manuals
   a. Provide operation and maintenance instructions and parts lists for all equipment provided in this contract. Formatting and content shall follow the guidelines outlined in the latest version of ASHRAE Application Handbook, Guideline.
   b. All instructions shall be submitted in draft, for approval, prior to final issue. Manufacturer's advertising literature or catalogs will not be acceptable for operating and maintenance instructions.
   c. The operation and maintenance document directory should provide easy access and be well organized and clearly identified.
   d. The operation and maintenance manuals shall contain the following information:
      1) Emergency information should be immediately available during emergencies and should include emergency and staff and/or agency notification procedures.
      2) Provide contacts (company name, address, phone number, email) where parts may be purchased for each principal item of equipment.

3) Provide detailed maintenance instructions, including recommended preventative maintenance schedules for all equipment requiring maintenance. For lighting and lighting controls, provide recommended driver replacement schedule, provide a schedule for inspecting and recalibrating lighting controls, and provide a recommended settings list for all components with adjustable settings.
4) General Information. Provide the following:
   a) Building function
   b) Building description
   c) Operating standards and logs
5) Technical Information. Provide the following:
   a) System description
   b) Operating routines and procedures
   c) Seasonal start-up and shutdown
   d) Special procedures
   e) Basic troubleshooting
6) Equipment data sheets. Provide the following:
   a) Vendor and local representative's contact information
   b) Operating and nameplate data
   c) Warranty
   d) Detailed operating instructions.
   e) Tools required
   f) Types of cleaners to use
7) Maintenance program information. Provide the following:
   a) Manufacturer's installation, operation, and maintenance instructions
   b) Spare parts information
   c) Preventive maintenance actions
   d) Schedule of actions
   e) Action description
   f) History
8) Test reports document observed performance during start-up and commissioning.
9) Reference Division 01 specifications for additional requirements.

e. Shop drawings will not be accepted as satisfying the requirement for Operation and Maintenance Manuals.
f. Submittals: Provide complete copies of all reviewed submittals. Where submittals were returned "Furnish as Corrected", the contractor shall make the corrections noted by the engineer and submit final corrected shop drawings with close-out documentation.
g. Parts List: Provide an inventory of all spare parts, special tools, attic stock, etc. that have been provided to the owner.

5. Warranty Documentation: Provide all documentation and certificates related to Contractor's warranty and all other specific manufacturer's warranties indicated in the construction documents.
6. Training Verification: Provide certification that all specified training has been completed. List training session dates, times, and types. Include any session materials and recordings.
7. Inspection Certificates: Provide certificates of inspection from electrical inspector, fire marshal, and any other required special inspections.
8. Reports and System Certifications: Provide final reports and any system certifications required in other specification sections.
9. Power Riser Diagram: Provide a framed and mounted full-size copy of the overall power riser diagram (under glass) to the Owner. Also, provide three vinyl-coated copies of same. Where an existing power riser diagram is present, the Contractor shall obtain the document from the Owner, and update in digital format with the scope of this project. Edits shall be in digital format and this work shall be closely coordinated with the Owner.

10. Software and Firmware Operational Documentation: Provide documentation, including the following:
    a. Software operating and upgrade manuals.
    b. Names, versions, and website addresses for locations of installed software.
    c. Device address list.
    d. Printouts of software application and graphic screens.
11. Software Back-ups: Provide software back-ups on USB media that is clearly and permanently labeled and provided with lanyard to prevent misplacement.

1.7 MAINTENANCE MATERIAL

A. Spare Parts and Extra Stock Material

1. Parts and Materials shall be properly marked and packaged for long term storage.

B. Special Tools and Keys:

1. Provide, along with the equipment provided, any special wrenches or tools necessary to dismantle or service equipment or appliances.
2. Wrenches shall include necessary keys, handles and operators for valves, switches, breakers, etc. and keys to electrical panels, alarm pull boxes and panels, etc.
3. Provide at least two of any such special wrench, keys, etc. to the Owner prior to completion of the project. Obtain a receipt that this has been accomplished and forward a copy to the Architect and Engineer.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of specified products of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five years unless otherwise approved.

1. The manufacturer shall have a valid ISO 9001 certification and an applicable quality assurance system that is regularly reviewed and audited by a third-party registrar. Manufacturing, inspection, and testing procedures shall be developed and controlled under the guidelines of the quality assurance system.
2. Equipment shall be supported by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

B. Installer Qualifications

1. All Electrical Contractors bidding this project must have been a licensed company for a minimum of three years to qualify to bid this project. Individual employee experience does not supersede this requirement.
2. All subcontractors bidding the electrical work must have completed one project of 70 percent this subcontract cost size and two projects of 50 percent this subcontract cost size.
3. All electrical work shall be accomplished by qualified workers competent in the area of work for which they are responsible. Untrained and incompetent workers as evidenced by their workmanship shall be relieved of their responsibilities in those areas. The Engineer shall reserve the right to determine the quality of workmanship of any worker and unqualified or incompetent workers shall refrain from work in areas not satisfactory to them. Requests for relief of a worker shall be made through the normal channels of responsibility established by the Architect or the contract document provisions.

4. All electrical work shall be accomplished by Journeymen electricians under the direct supervision of a licensed Electrician.
5. Special electrical systems, such as Fire Alarm Systems, Telecommunications or Data Systems, Video Systems, Special Electronic Systems, Control Systems, etc., shall be installed by workers normally engaged or employed in these respective trades. Refer to Divisions 27 and 28 for additional requirements.

C. Licensed Professional Engineer Qualifications: Professional Engineer possessing active qualifications in accordance with Division 01 and licensed by the State in which the Work is being performed.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver or install indoor equipment until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above equipment is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.10 FIELD CONDITIONS

A. Ambient Conditions:

1. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

1.11 WARRANTIES

A. Contractor Warranty: Contractor shall unconditionally guarantee all equipment, apparatus, materials, and workmanship entering into this Contract to be the best of its respective kind and shall replace all parts at their own expense, which fail or are proven defective within one year from Substantial Completion of the work by the Engineer. The effective date of completion of the work shall be the date each or any portion of the work is accepted by the Architect, Engineer, and Owner’s Statement of Substantial Completion.

B. Manufacturer Warranty: Items of equipment which have longer guarantees, as called for in these specifications or as otherwise offered by the manufacturer shall have warranties and guarantees completed in order and shall be in effect at the time of final acceptance of the work by the Engineer. The Contractor shall present the Engineer with such warranties and guarantees at the time of final acceptance of the work. The Owner reserves the right to use equipment installed by the Contractor prior to date of final acceptance. Such use of equipment shall in no way invalidate the guarantee except that the Owner shall be liable for any damage to equipment during this period due to negligence of his operator or other employee.

C. The Warranties specified herein, and other Sections shall not deprive the Owner of other rights the Owner may have under provisions of the Contract Documents and shall be in addition to, and run concurrently with other warranties made by the Contractor under requirements of the Contract Documents.

1.12 INDEMNIFICATION

A. The Contractor shall hold harmless and indemnify the Engineer, employees, officers, agents and consultants from all claims, loss, damage, actions, causes of actions, expense and/or liability resulting from, brought for, or on account of any personal injury or property damage received or sustained by any person, persons, (including third parties), or any property growing out of, occurring, or attributable to any work performed under or related to this contract, resulting in whole or in part from the negligence of the Contractor, any subcontractor, any employee, agent or representative.

1.13 HAZARDOUS MATERIALS

A. The Contractor is hereby advised that it is possible that asbestos and/or other hazardous materials are or were present in this building(s). Any worker, occupant, visitor, inspector, etc., who encounters any material of whose content they are not certain shall promptly report the existence and location of that material to the Contractor and/or Owner. The Contractor shall, as a part of their work, ensure their workers are aware of this potential and what they are to do in the event of suspicion. The Contractor shall also keep uninformed persons from the premises during construction. Furthermore, the Contractor shall insure that no one comes near to or in contact with any such material or fumes therefrom until its content can be ascertained to be non-hazardous.

B. CMTA, Inc., Consulting Engineers, have no expertise in the determination of the presence of hazardous materials. Therefore, no attempt has been made by them to identify the existence or location of any such material. Furthermore, CMTA nor any affiliate thereof will neither offer nor make any recommendations relative to the removal, handling, or disposal of such material.

C. If the work interfaces, connects or relates in any way with or to existing components which contain or bear any hazardous material, asbestos being one, then, it shall be the Contractor's sole responsibility to contact the Owner immediately.

D. The Contractor by execution of the contract for any work and/or by the accomplishment of any work thereby agrees to bring no claim relative to hazardous materials for negligence, breach of contract, indemnity, or any other such item against CMTA, its principals, employees, agents, or consultants. Also, the Contractor further agrees to defend, indemnify, and hold CMTA, its principals, employees, agents, and consultants, harmless from any such related claims which may be brought by any subcontractors, suppliers or any other third parties.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency suitable to the AHJ, and marked for intended location and application.

B. Materials used shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards, other applicable federal, state, and local laws.

C. Standard Products

1. Except where specifically noted otherwise, all equipment supplied by the Contractor shall be the standard products of a single manufacturer of known reputation and experience in the industry.
2. Only equipment, components, and accessories in current production for at least five years beyond the completion date of this system shall be used and installed. Any equipment found to be obsolete or not in future production will be removed and replaced at Contractor's expense. This includes all equipment, materials, and labor.
3. Products manufactured more than 2 years prior to date of delivery to site shall not be used, unless specified otherwise.

D. Product numbers are subject to change by the manufacturer without notification. In the event a product number is invalid or conflicts with the written description, notify the Engineer in writing prior to ordering the material and performing installation work.

2.2 PRODUCT SUBSTITUTIONS

A. Conform to the substitutions requirements and procedures outlined in Division 01.

B. One substitution for each product specified will be considered and substitutions must be submitted to Engineer a minimum of 10 days prior to bid using the standard CSI substitution request form.

C. If prevailing laws of cities, towns, states, or countries are more stringent than these specifications regarding such substitutions, then those laws shall prevail over these requirements.

D. Where products are noted as "or equal", a product of equivalent design, manufacture, and performance will be considered. Submit product data (product information, catalog cut sheets, test data, etc.) to substantiate that the product is in fact equivalent to that specified. The burden of proof that the substituted product is equivalent to the specified product rests with the Contractor. Whenever material, process or equipment is specified in accordance with an industry specification (ANSI, TIA, etc.), UL rating, or other association standard, present an affidavit from the manufacturer certifying that the product complies with the particular standard specification. When requested by the Engineer, submit supporting test data to substantiate compliance.

E. Manufacturers' names and model numbers used in conjunction with materials, processes or equipment included in the contract documents are used to establish standards of quality, utility and appearance and shall not be construed as limiting competition. Materials, processes, or equipment that, in the opinion of the Engineer, are equivalent in quality, utility and appearance will be approved as substitutions to that specified when "or equal" follows the manufacturers' names or model number(s).

F. When the Engineer accepts a substitution in writing, it is with the understanding that the Contractor guarantees the substituted product, component, article, or material to be equivalent to the one specified and dimensioned to fit within the construction according to contract documents. Do not provide substituted material, processes, or equipment without written authorization from the Engineer. Assumptions on the acceptability of a proposed substitution, prior to acceptance by the Engineer, are at the sole risk of the Contractor.

G. Approved substitutions shall not relieve the Contractor of responsibilities for the proper execution of the work, or from provisions of the specifications.

H. Contractor shall pay expenses, without additional charge to the Owner, in connection with substitution materials, processes and equipment, including the effect of substitution on their work or other Contractor's work.

I. In all cases where substitutions affect other trades, the Contractor offering such substitutions shall advise all such Contractors of the change and shall reimburse them for all necessary changes in their work. Any Drawings, Specifications, Diagrams, etc., required to describe and coordinate such substitutions or deviations shall be professionally prepared at the responsible Contractor's expense. Review of Shop Drawings by the Engineer does not absolve the Contractor of this responsibility.

J. Contractor shall be responsible and assume all costs for removal and replacement of any substituted product installed without prior written approval. Such costs shall include, but not be limited to labor, materials as well as any penalties, fees or costs incurred for late completion.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Supervision of Work: Each Contractor and Sub-Contractors shall personally supervise the work or have a competent superintendent on the project site at all times during progress of the work, with full authority to act in matters related to the project.

B. Conduct of Workmen: The Contractor shall be responsible for the conduct of all workmen under their supervision. Misconduct on the part of any workmen to the extent of creating a safety hazard, or endangering the lives and property of others, shall result in the prompt relief of that workman. The consumption or influence of alcoholic beverages, narcotics or illegally used controlled substances on the jobsite is strictly forbidden. Possession of a fire-arm is prohibited and may result in prosecution. Foul or bad language, graffiti is strictly prohibited. Display of nude tattoos is prohibited.

C. No tobacco use, including smokeless tobacco, is allowed on property.

3.2 EXAMINATION

A. Each Contractor shall inform themself of all of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work. All Contractors shall carefully examine all Drawings and Specifications and inform themselves of the kind and type of materials to be used throughout the project and which may, in any way, affect the execution of their work.

B. Each Contractor shall fully acquaint themself with all existing conditions as to ingress and egress, distance of haul from supply points, routes for transportation of materials, facilities and services, availability of temporary or permanent utilities, etc. The Contractor shall include in their work all expenses or disbursements in connection with such matters and conditions. Each Contractor shall verify all work shown on the drawings and conditions at the site and shall report in writing to the Engineer ten days prior to bid, any apparent omissions, or discrepancies in order that clarifications may be issued by written addendum. No allowance is to be made for lack of knowledge concerning such conditions after bids are accepted.

3.3 PREPARATION

A. Surveys, Measurements, and Grades

1. The Contractor shall lay out their work and be responsible for all necessary lines, levels, elevations, and measurements. They must verify the figures shown on the drawings before laying out the work and will be held responsible for any error resulting from their failure to do so.
2. Base all measurements, both horizontal and vertical from established bench marks. All work shall agree with these established lines and levels. Verify all measurements at site and check the correctness of same as related to the work.
3. Should the Contractor discover any discrepancy between actual measurements and those indicated, which prevents following good practice or the intent of the drawings and specifications, they shall notify the Engineer through normal channels of job communication and shall not proceed with his work until they have received instructions from the Engineer.

3.4 INSTALLATION

A. At no time shall the contractor work on energized electrical equipment. Contractor shall comply with NFPA 70E requirements at all times throughout construction.

B. Permits and Fees

1. The Contractor shall give all necessary notices, obtain, and pay for all permits, government sales taxes, fees, and other costs in connection with their work. As necessary, the Contractor shall file all required plans, utility easement requests and drawings, survey information on line locations, load calculations, etc., prepare all documents and obtain all necessary approvals of all utility and governmental departments having jurisdiction; obtain all required certificates of inspection for their work and deliver same to the Engineer before request for final acceptance and final payment for the work.
2. Ignorance of Codes, Rules, regulations, utility company requirements, laws, etc., shall not diminish or absolve Contractor's responsibilities to provide and complete all work in compliance with such.

C. Codes and Regulations

1. The Contractor shall include in the work, without extra cost, any labor, materials, services, apparatus, or drawings required in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings and/or specified.
2. All materials furnished and all work installed shall comply with the adopted edition of the National Electrical Codes, National Fire Codes of the National Fire Protection Association, the requirements of local utility companies, and with the requirements of all governmental agencies or departments having jurisdiction.
3. All electrical work is to be constructed and installed in accordance with plans and specifications which have been approved in their entirety and/or reflect any changes requested by the AHJ, as applicable or required. Electrical work shall not commence until such plans are in the hands of the Electrical Contractor.
4. The Contractor shall insure their work is accomplished in accord with OSHA Standards and any other applicable government requirements.
5. Where conflict arises between any code and the contract documents, the code shall apply except in the instance where the plans and specifications exceed the requirements of the code. Any changes required as a result of these conflicts shall be brought to the attention of the Engineer at least ten working days prior to bid date, otherwise the Contractor shall make the required changes at their own expense. The provisions of the codes constitute

minimum standards for wiring methods, materials, equipment and construction and compliance therewith will be required for all electrical work, except where the drawings and specifications require better materials, equipment, and construction than these minimum standards, in which case the drawings and specifications shall be the minimum standards.

D. Materials and Workmanship

1. All electrical equipment, materials and articles incorporated in the work shall be new and of equal quality to the specified basis of design. All workmanship shall be first-class and shall be performed by electricians skilled and regularly employed in their respective trades.
2. The Contractor shall determine that the equipment he proposes to furnish can be brought into the building(s) and installed within the space available. All equipment shall be installed so that all parts are readily accessible for inspection, maintenance, replacement, etc. Extra compensation will not be allowed for relocation of equipment for accessibility or for dismantling equipment to obtain entrance into the building(s).
3. All fixtures, devices and wiring required shall be installed to make up complete systems as indicated on the drawings and specified herein.
4. All electrical materials, equipment and appliances shall conform to the latest standards of the National Electric Manufacturers Association (NEMA) and the National Board of Fire Underwriters (NBFU) and shall be approved by the Owner's insuring agency if so required.
5. Comply with National Electrical Contractors Association (NECA) performance standards that are published as National Electrical Installation Standards (NEIS).
6. All applicable equipment and devices provided shall meet all FCC requirements and restrictions.

E. Weatherproofing

1. Where any work penetrates waterproofing, including waterproof concrete, the method of installation shall be as approved by the Architect and/or Engineer before work is done. The Contractor shall furnish all necessary sleeves, caulking and flashing required to make openings absolutely watertight.
2. Wherever work penetrates roofing, it shall be done in a manner that will not diminish or void the roofing guarantee or warranty in any way. Coordinate all such work with the roofing installer.

F. Equipment Access

1. The Contractor shall be responsible for the sufficiency of the size of shafts and chases, the adequate clearance in partitions and above suspended ceilings for the proper installation of their work. Cooperate with the Prime Contractor and all other Contractors whose work is in the same space and advise each Contractor of equipment requirements. Such spaces and clearances shall be kept to the minimum size required to ensure adequate clearance and access.
2. The Contractor shall locate all equipment which must be serviced, operated, or maintained in fully accessible positions. Equipment shall include but not be limited to junction boxes, pull boxes, contactors, panels, disconnects, controllers, switchgear, etc. Minor deviations from drawings may be made to allow for better accessibility, and any change shall be approved where the equipment is concealed.
3. Each Contractor shall provide (or arrange for the provision by other trades) the access panels for each concealed junction box, pull box, fixtures or electrical device requiring access or service as shown on Engineer's plans or as required. Locations of these panels shall be identified in sufficient time to be installed in the normal course of work. All access panels shall be installed in accord with the Architect's standards for such work. In the absence of such specifications, at a minimum such work shall comply with the specifications below. All locations for access panels which are not specifically indicated on the drawings shall be submitted to and approved by the architect prior to ordering.

4. Access Doors; in Ceilings or Walls:
   a. In mechanical, electrical, and service spaces: 14-gauge aluminum brushed satin finish, 1" border.
   b. In finished areas: 14-gauge primed steel with 1" border to accept the architectural finishes specified for the space. Confirm these provisions with the Architect prior to obtaining materials or installing any such work.
   c. In fire or smoke rated partitions, access doors shall be provided that equal or exceed the required rating of the construction they are mounted in.

G. Connections

1. Provide rough-in and final connections to all electrically operated equipment furnished under the Work of the contract documents. Carefully coordinate with equipment suppliers, manufacturer's representatives, vendors, and other trades to provide complete electrical and dimensional interface to all equipment.
2. Provide all power wiring complete from power source to motor or equipment junction box, including power wiring through starters or contactors. Install all starters not factory mounted on equipment.
3. Provide all control, interlock, sensor, thermocouple, and other connections required for equipment operation. Coordinate ampacity and voltage characteristics for all motors and equipment.
4. Prior to bidding the work, coordinate power, control, sensor, interlock and all other wiring requirements for equipment or motors with all other trades, to ensure all needed wiring is provided. Failure to provide such coordination shall not be justification for claims of extra compensation of a time extension to the Contract.
5. At no times shall the contractor work on energized electrical equipment. Comply with NFPA 70E requirements at all times during construction.

H. Scaffolding, Rigging, and Hoisting: The Contractor shall furnish all scaffolding, rigging, hoisting, and services necessary for erection and delivery into the premises of any equipment and apparatus furnished. All such temporary appurtenances shall be set up in strict accord with OSHA Standards and Requirements. Remove same from premises when no longer required.

3.5 RESTORATION

A. The Contractor shall replace to their original condition all paving, curbing surfaces, drainage ditches, structures, fences, shrubs, existing or new building surfaces and appurtenances, and any other items damaged or removed by his operations. Replacement and repairs shall be in accordance with good construction practice and shall match materials employed in the original construction of the item to be replaced. All repairs shall be to the satisfaction of the Engineer, and in accord with the Architect's standards for such work, as applicable. Patchwork on new construction will not be accepted.

3.6 INDETIFICATION AND OPERATING INSTRUCTIONS

A. Provide all equipment with a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

B. Provide operating instructions for each system and principal item of equipment as specified in the technical sections for use by operation and maintenance personnel. The operating instructions shall include the following:

1. Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
2. Start up, proper adjustment, operating, lubrication, and shutdown procedures.
3. Safety precautions.
4. The procedure in the event of equipment failure.
5. Other items of instruction as recommended by the manufacturer of each system or item of equipment.

C. Print or engrave operating instructions and frame under glass or in approved laminated plastic. Post instructions where directed. For operating instructions exposed to the weather, provide weather-resistant materials or weatherproof enclosures. Operating instructions shall not fade when exposed to sunlight and shall be secured to prevent easy removal or peeling.

3.7 SYSTEM TESTING, VERIFICATION, AND START-UP

A. The Contractor (and Sub-Contractors) shall be responsible for starting-up, testing, checking, examining, inspecting, and verifying their systems.

B. The Electrical Contractor shall designate an individual under their employment to lead the start-up, testing and verification process. This person should not be the project manager or job site superintendent, but a person dedicated to making this critical task successful and completed in a timely manner.

C. A pre-start-up conference shall be held with the Architect, Owner, Contractors, and the Manufacturer providing startup services. The purpose of this meeting will be to discuss the goals, procedures, etc. for start-up.

D. The Contractor shall include in the bid to provide systems startup and verification for all electrical systems specified for this project. Specific startup, testing, and verification requirements are included throughout the Electrical specifications. In general, as part of the verification process, equipment suppliers shall perform start-up by their factory authorized technicians (unless noted otherwise) and shall complete and submit start-up reports/checklists. Submit start-up reports to the Engineer. The Contractor shall have appropriate trades on site to correct all deficiencies noted by the factory representative. For each deficiency noted, documentation of corrective action (including date and time) shall be submitted to the Engineer and Owner.

E. Where manufacturer start-up is not specified for a particular piece of equipment or system, the Contractor shall be responsible to perform start-up in strict accordance with manufacturer’s instructions.

F. The Contractor shall be responsible for completion of a System Verification Checklist (SVC) / Manufacturer’s Checklists. Furnish to the Testing Agent and Engineer. Sample checklists shall be submitted to the Engineer, Owner, and Testing Agent for approval.

G. The completed reports shall be organized and bound together in a tabbed binder and submitted for review and approval.

3.8 FIELD QUALITY CONTROL

A. Inspections

1. Before requesting a final review of the installation from the Architect and/or Engineer, the Contractor shall thoroughly inspect the installation to assure that the work is complete in

every detail and that all requirements of the Contract Documents have been fulfilled. Failure to accomplish this may result in charges from the Architect and/or Engineers for unnecessary and undue work on their part.

2. Owner's and Engineer's inspections: Two inspections will be held to generate and then review punchlist items. All site inspections and visits thereafter shall be billed to the Contractor at the Engineer's standard hourly rates.
3. The Contractor shall provide as a part of this contract electrical inspection by a competent Electrical Inspection Agency, licensed to provide such services. The name of this agency shall be included in the list of materials of the Form of Proposal by the Contractor. All costs incidental to the provision of electrical inspections shall be borne by the Electrical Contractor.
4. The Contractor shall advise each Inspection Agency in writing (with an information copy of the correspondence to the Architect and/or Engineer) when they anticipate commencing work. Failure of the Inspection Agency to inspect the work in the stage following and submit the related reports may result in the Contractor's having to expose concealed work not so inspected. Costs associated with any rework, cutting, and patching will be at the expense of the responsible Contractor.
5. Inspections shall be scheduled for rough-in as well as finished work. The rough inspections shall be divided into as many inspections as may be necessary to correct deficiencies. Report of each such inspection visit shall be submitted to the Architect, Engineer, and the Contractor within three days of the inspection.
6. Approval by an Inspector does not relieve the Contractor from the responsibilities of furnishing equipment having a quality of performance equivalent to the requirements set forth in these plans and specifications. All work under this contract is subject to the review of the Architect and/or Engineer, whose decision is binding.
7. Before final acceptance, the Contractor shall furnish three copies of the certificates of final approval by the Electrical Inspector (as well as all other inspection certificates) to the Engineer with one copy of each to the appropriate government agencies, as applicable. Final payment for the work shall be contingent upon completion of this requirement.

B. Punch Lists

1. The Contractor shall review each area and prepare a punch list for each of the subcontractors, as applicable, for at least three stages of the project.
    a. For review of in-wall work that will be concealed by drywall or other materials well before substantial completion.
    b. For review of the above-ceiling work that will be concealed by tile or other materials well before substantial completion.
    c. For review of all other work as the project nears substantial completion.
2. When all work from the Contractor’s punch list is complete at each of these stages and prior to completing ceiling installations (or at the final punch list stage), the Contractor shall request that the Engineer develop a punch list. This request is to be made in writing two weeks prior to the proposed date.
3. After all corrections have been made from the Engineer's punch list, the Contractor shall review and initial off on each item. This signed-off punch list shall be submitted to the Engineer. The Engineer shall return to the site once to review each punch list and all work prior to the ceilings being installed and at the final punch list review.
4. At the engineer’s option, the contractor shall supply digital photographs via email or file-share of any installed work.
5. If additional visits are required by the Engineer to review work not completed by this review, the Engineer shall be reimbursed directly by the Contractor by check or money order (due 10 days from date of each additional visit) at a rate of $125.00 per hour for extra trips required to complete either of the above-ceiling or final punch lists.

6. All panelboard fronts shall be removed prior to final punch list inspection and re-installed after completion. Directories for each panelboard shall be completed and available for review by the Engineer at that time.

3.9 CLEANING

A. The Contractor shall, at all times, keep the area of work presentable to the public and clean of rubbish caused by their operations; and at the completion of the work, shall remove all rubbish, all tools, equipment, temporary work, and surplus materials, from and about the premises, and shall leave the work clean and ready for use. If the Contractor does not attend to such cleaning immediately upon request, the Engineer may cause cleaning to be done by others and charge the cost of same to the responsible Contractor. Each Contractor shall be responsible for all damage from fire which originates in, or is propagated by, accumulations of rubbish or debris.

B. After completion of all work and before final acceptance of the work, each Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of materials, equipment, and all associated fabrication. Pay particular attention to finished area surfaces such as lighting fixture lenses, lamps, reflectors, panels, etc.

3.10 TRAINING

A. Upon completion of all work and all tests, each Contractor shall furnish the necessary skilled labor and helpers for operating all systems and equipment for a period of three days of eight hours each, or as otherwise specified. During this period, instruct the Owner or their representative fully in the operations, adjustment, and maintenance of all equipment furnished. Give at least one week's written notice to the Owner, Architect and Engineer in advance of this period. The Engineer may attend any such training sessions or operational demonstrations. The Contractor shall certify in writing to the Engineer that such demonstrations have taken place, noting the date, time and names of the Owner's representative that were present.

B. Training shall be accompanied by complete as-built documentation and the technical systems operation manual.

C. The training shall be accomplished by a factory trained representative. Include a minimum of Four hours for each system described here-in unless noted otherwise. Each equipment representative shall be represented wherever their equipment is used.

D. Demonstration and Training DVDs: These training sessions shall be videotaped by the Installer. Submit two copies within seven days of end of each training module. On each copy, provide an applied label with the following information:

1. Name of Project.
2. Name and address of photographer.
3. Name of Architect and Construction Manager.
4. Name of Contractor.
5. Date video was recorded.

E. Brochures: Furnish Owner a complete set of operating instructions and diagrams.

F. Instruction Program: Submit outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

G. At completion of training, submit two complete training manual(s) for Owner's use.

H. Qualification Data: For facilitator, instructor, and photographer.

I. Attendance Record: For each training module, submit list of participants and length of instruction time.

3.11 PROTECTION

A. The Contractor shall be entirely responsible for all material and equipment furnished for their work and special care shall be taken to properly protect all parts thereof from damage during the construction period. Such protection shall be by a means acceptable to the Engineer. Equipment damaged while stored on site either before or after installation shall be repaired or replaced (as determined by the Engineer) by the responsible Contractor. Electrical equipment exposed to the weather shall be replaced by the Contractor at their own expense.

END OF GENERAL REQUIREMENTS FOR ELETRICAL SYSTEMS

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Slotted Support Systems.
2. Conduit and Cable Supports.
3. Mounting, Anchoring, and Attachment Components.
4. Fabricated Metal Supports.
5. Concrete Bases.
6. Vibration Isolation pads.
7. Sleeves for penetration of non-fire-rated construction walls and floors.
8. Sleeve-seal systems.
9. Firestopping.
10. Cutting and Patching
11. Painting

B. Related Requirements:

1. Refer to Section 260548 “Seismic Controls for Electrical Systems” for products and installation requirements necessary for compliance with seismic criteria.

1.3 REFERENCES

A. Abbreviations and Acronyms

1. EMT: Electrical Metallic Tubing.
2. FMC: Flexible Metal Conduit.
3. GRC/GRS: Galvanized Rigid Steel Conduit.
4. LFMC: Liquid-tight flexible metal conduit.
5. RMC: Rigid Metal Conduit

B. Definitions

1. Channel: A continuous slotted channel (strut) with inturned lips suitable for assembly into multiple configurations

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. Metal Framing Manufacturers Association (MFMA)
   a. MFMA-4: Metal Framing Standards Publication

b. MFMA-103: Guidelines for the use of Metal Framing

1.4 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations with Division 07 Section "Roof Accessories."

1.5 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of components, profiles, and finishes.
2. Include rated capacities.

B. Shop Drawings: For fabrication and installation details and include calculations for the following:

1. Slotted channel systems.
2. Equipment supports.
3. Concrete Bases for Equipment.
4. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

C. Delegated-Design Submittal: Signed and sealed by a qualified professional engineer. For field assembled or fabricated hangers and supports for electrical systems.

1. Include design calculations and details of trapeze hangers.

D. Qualification Data: For professional engineer.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to the authority having jurisdiction and marked for intended location and application.

B. Delegated Design: Design support systems, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

2.2 SLOTTED SUPPORT SYSTEMS

A. Description: Preformed, continuous slot, bolted channels with associated fittings and hardware.

1. Available Manufacturers: Subject to compliance with requirements, provide products from one of the following or an approved equal:

   a. Eaton B-Line.
   b. Kindorf.
   c. nVent Caddy.
   d. Power-Strut.
   e. SuperStrut.
   f. Unistrut.

2. Comply with MFMA-4 for factory fabricated components suitable for field assembly.
3. Material and Finish for channel, fittings, and accessories:

   a. Steel: Minimum 16 gauge, Hot-dip galvanized after fabrication and applied according to ASTM A123 or A153 suitable for indoor or outdoor wet locations.
   b. Fiberglass: UV-resistant, fire retardant, fiberglass-reinforced polyester resin suitable for corrosive environments.

4. Channel Dimensions: Minimum 1-5/8 inches wide with varying heights and welded combinations selected to meet applicable load criteria.

2.3 CONDUIT AND CABLE SUPPORTS

A. Available Manufacturers: Subject to compliance with requirements, provide products from one of the following or an approved equal:

1. Eaton B-Line
2. nVent Caddy
3. Thomas & Betts

B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Provide plugs with number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported.

D. Device Box Mounting Brackets: Factory-fabricated sheet steel brackets for support of device boxes adjacent to or between studs.

E. Through-Stud Cable and Raceway Support Clips: Factory-fabricated spring steel clip for cables or raceways where run horizontally through metal studs.

F. Roof-mounted Raceway Support Blocking: Non-penetrating, factory-fabricated support blocking for use under roof-mounted raceways. Wedge-shaped blocking constructed of 100% recycled UV-resistant Rubber with integral galvanized steel strut to accept raceway support clips.

G. Tee Bar Grid Box Hanger: Factory-fabricated metal electrical box hanger for supporting boxes at locations between ceiling system t-grid components. Height adjustable for various electrical box depths. Attached to ceiling tee bar with screws or integral clamp for stability. Includes tab for independent support wire attachment.

2.4 MOUNTING, ANCHORING, AND ATTACHMENT COMPONENTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton B-Line
2. Empire Industries.
3. Hilti.
4. ITW.
5. MKT Fastening.

B. Description: Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened Portland cement concrete, or steel with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
3. Concrete Inserts: Steel, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Solid, threaded steel.

2.5 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

2.6 VIBRATION ISOLATION PADS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Korfund Maxi-Flex Pads or a comparable product by one of the following:

1. Ace Mountings Co.
2. California Dynamics Corporation.
3. Eaton B-Line.
4. Kinetics Noise Control.
5. Mason Industries.
6. Vibration Eliminator Co.
7. VMC Group

B. Description: Molded, oil resistant, non-skid elastomeric pads arranged in 2-inch square segments.

C. Load Rating from 120 lbs. up to 360 lbs. per 2-inch segment.

2.7 SLEEVES

A. Wall and Floor Sleeves:

1. Galvanized Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

2.8 SLEEVE-SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable. Link Seal system or approved equal.

1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Glass reinforced nylon polymer.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.9 FIRESTOPPING FOR ELECTRICAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following or approved equal:

1. Hilti
2. Specified Technologies Inc (STI)
3. Wiremold

B. Source Limitations: Obtain firestopping systems through one source from a single manufacturer.

C. General Requirements:

1. Firestopping systems shall bear UL classification marking corresponding to its Fire Resistance Directory.
2. Comply with testing requirements set forth in ASTM E814 or UL 1479.
3. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
4. Provide components for each through-penetration firestop system that are needed to install fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

D. Fire rated cable pathways: Re-penetrable, maintenance-free cable management devices for use with cable bundles penetrating through fire rated walls or floors.

1. Shall contain a built-in fire sealing system sufficient to maintain the hourly rating of the fire rated wall or floor being penetrated.
2. The system shall adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall firestop materials.
3. Shall be engineered to allow two or more devices to be ganged together with wall plates for larger cable capacities.

E. Fire-rated cable grommets: Molded, two-piece grommet with sealing membrane for use with single cables or small bundles at through or membrane wall penetrations.

1. System shall be installed around cables and shall lock tightly into the wall assembly.

F. Outlet Box Putty Pads: Non-hardening, moldable, intumescent material shaped into preformed pads for use with metallic outlet boxes.

G. Refer to Division 07 for requirements related to other firestopping systems and materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation devices for compliance with manufacturer's installation requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CUTTING AND PATCHING

A. Unless otherwise indicated, provide cutting and patching necessary to install the work specified. Patching shall match adjacent surfaces to the satisfaction of the Engineer and shall be in accordance with the Architect's standards for such work.

B. Do not cut structural elements without reinforcing the structure to maintain the designed weight bearing and stiffness. Coordinate approved reinforcement method with Architect and Structural Engineer.

3.3 SUPPORT SYSTEM APPLICATION

A. Comply with NFPA 70, NECA 1, NECA 101, and MFMA-103 for application of hangers and supports for electrical equipment and systems except where requirements of this Section are more stringent.

B. Maximum Horizontal and Vertical Support Spacing for Raceway(s): Space supports for raceways as required by NFPA 70.

C. Minimum Hanger Rod Size for Raceway Supports: 3/8-inch diameter unless noted otherwise.

D. Single Raceways:

1. For Raceways 1-1/4-inch and smaller: Install adjustable steel band hanger suspended on threaded rod.

2. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/4-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

E. Multiple Raceways and single raceways larger than 1-1/4-inch:

1. Install trapeze-type supports fabricated with slotted support system suspended on threaded rods for horizontal applications and fastened to building structure for vertical applications.
2. Size so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
3. Secure raceways and cables to these supports with two-bolt steel conduit clamps or single-bolt steel conduit clamps using spring friction action for retention in support channel.

3.4 SUPPORT SYSTEM INSTALLATION

A. Comply with NFPA 70, NECA 1, NECA 101, and MFMA-103 for installation requirements except where requirements of this Article are more stringent.

B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components multiplied by a safety factor of four with a minimum of 200 lbs.

C. Mounting and Anchorage of Surface-Mounted or Recessed-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To Wood: Fasten with lag screws or through bolts.
2. To New Concrete: Bolt to concrete inserts.
   a. Where support anchors are required, establish their type, and locate in concrete construction before concrete is poured. Fit each hanger rod with a nut at its upper end and set nut in a universal concrete insert in the form. Where supported weight exceeds holding strength of a single insert, pass rods through top slot of inserts and interlock with reinforcing steel. Also, where particularly heavy loads are to be supported, suspend hanger rod or rods from a structural angle spanning two or more inserts and securely bolted thereto to distribute the weight.
3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To Existing Concrete: Self-drilling concrete anchors or expansion anchor fasteners.
5. To Steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69 or Spring-tension clamps.
6. To Light Steel: Sheet metal screws.
7. For Surface-Mounted Items on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to structure. Attachment to gypsum wall board is not acceptable as sole support means; slotted-channel rack solidly attached to structure or light-gauge metal framing at both ends is required.
8. For Recessed-Mounted Items in Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices to intermediate light-gauge metal framing members on each side of device or provide slotted-channel racks within hollow wall attached to structure by means that meet anchorage requirements. Attachment to gypsum wall board is not acceptable as sole support means.

D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars or existing raceways embedded in slab. Verify reinforcing locations with Structural Engineer and X-Ray existing concrete structures as required.

E. Do not support any items (equipment, piping, conduit, etc.) exceeding 2 inches in diameter from the bottom of slabs. Where intermediate supports are required between structural members, use slotted steel channels support systems attached to beams or joists in order to avoid attachment to slabs.

F. Slotted Support Systems

1. Install slotted channel systems level and plumb.
2. Remove burrs from all exposed cut edges prior to installation.

G. Wall Stud and Ceiling Supports

1. Fasten junction, pull and devices boxes securely to the building construction, independent of raceway system.
2. Install Device Box Mounting Brackets supported between two studs. Attach all device boxes to two studs, device box stabilizers are prohibited.
3. Install Tee Bar Grid Box Hanger supported between two ceiling grid tee bars where devices boxes are located flush in recessed suspended ceilings. Install at least one independent support rod from box hanger to structure.
4. Install Through-Stud Cable and Raceway Support Clips where cables or raceways run horizontally through metal studs.

H. Install Roof-mounted Raceway Support Blocking where raceways run on across roofing.

1. Coordinate installation of roof supports with items specified in Division 07 Section "Roof Accessories." Provide products compatible with rooftop materials included in the Work to maintain warranty of roof system.

I. Threaded Rod Hardware

1. Provide minimum of two lock nuts per threaded support rod except where lock nut tightens against a threaded socket, one locknut may be used.
2. Trim rod excess to within 1-inch of locknut, de-burr, and provide protective endcap.

J. Support raceways at a distance above suspended ceilings to permit removal of ceiling panels and luminaires.

K. Locate raceways and supports so as not to hinder function or code required clearance to any system or equipment.

L. Provide independent supports and hang all electrical raceways and devices from the building structure with UL listed and approved materials. Utilizing the support systems of other trade’s work is prohibited, except with written approval from the Engineer.

M. Provide riser support clamps for vertical conduit runs and install at each floor level penetration and at additional locations required to support weight of system.

N. Tighten all bolted connections to proper torque values in accordance with manufacturer’s written instructions.

O. Provide supports to maintain 1/4-inch air space between raceway and mounting surface where raceways are mounted exposed in wet or corrosive locations and where directly attached to concrete or masonry.

P. The use of tie wire or perforated metal tape for support or fastening of any raceway system is prohibited.

Q. Where galvanized wire is used for cable supports above suspended ceilings, provide minimum #12 support wire independent of ceiling system secured at both ends. Paint or provide tag to distinguish supports from ceiling system.

R. Welding directly on raceways, fittings, or outlet boxes is prohibited.

3.5 INSTALLATION OF VIBRATION ISOLATION PADS

A. Select vibration device load ratings to match equipment loading and deflection criteria.

B. Arrange pads in single or multiple layers of sufficient stiffness for uniform loading.

C. Install pre-cut segments in accordance with manufacturer recommendations to match shape of equipment base.

3.6 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.7 CONCRETE EQUIPMENT BASES

A. Housekeeping Pads: Construct concrete housekeeping pads a minimum of 4-inches thick and 6-inches larger in both directions than supported unit.

B. Exterior Equipment Pads: Construct exterior equipment pads a minimum of 8-inches thick and 6-inches larger in both directions than supported unit unless noted otherwise.

C. Use 3000-psi, 28-day compressive-strength concrete unless otherwise noted. Comply with Division 03 Section "Cast-in-Place Concrete" and ACI standards for subbase requirements, concrete materials, reinforcement, placement, and cover requirements.

1. Reinforce pads with a minimum #4 rebar on 12-inch centers each way or equivalent welded wire fabric. Support reinforcement and tie together to prevent displacement during construction.
2. For interior pads, provide #4 dowels at 24-inch centers each way (minimum of 4) to anchor to structural slab below. Embed dowels into slab a minimum of 3-inches.
3. Provide rubbed finish for all surfaces.
4. Provide ¾-inch chamfer at all exposed edges.
5. Provide Engineer approved repairs if pad surface is rough or shows signs of honeycomb.

6. Provide crown for exterior pads with a slope of 1/8-inch per foot.
7. Do not set heavy equipment on pad for at least 7 days after pour unless approved by Engineer.

D. Anchor equipment to concrete base.

1. Locate anchors to be a minimum of 10 bolt diameters from edge of the base.
2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
3. Install anchor bolts to elevations required for proper attachment to supported equipment.
4. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.8 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

A. Comply with NECA 1.

B. Coordinate all required openings and provide sleeves and inserts prior to construction of wall and floor systems. Where openings are missed or incorrectly located, provide core-drilling and patching at no additional expense to owner.

C. Install sleeves without compromising structural integrity of wall or floor.

D. Sleeves for Conduits or Cable Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:

1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
   a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
   b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall, so no voids remain. Tool exposed surfaces smooth; protect material while curing.
2. Unless sleeve seal systems are used, size pipe sleeves to provide a minimum 1/4-inch annular clear space between sleeve and raceway. Where conduit motion due to expansion and contraction will occur, provide sleeves a minimum of two conduit sizes larger than the nominal conduit diameter.
3. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls.
   a. For conduit penetrations, cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
   b. For cable penetrations, extend sleeve a minimum of 2-inches beyond surface of wall and provide plastic insulated bushing.
4. Install sleeves for floor penetrations. Extend sleeves installed in floors a minimum of 6-inches above finished floor level unless noted otherwise. Install sleeves during erection of floors.
5. Fasten sleeves securely in floors, walls, so that they will not become displaced when concrete is poured or when other construction occurs around them. Take precautions to prevent concrete, plaster or other materials being forced into the space between pipe and sleeve during construction.

E. Sleeves for Cables Penetrating Non-Fire-Rated Gypsum Board Assemblies:

1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Seal space outside of sleeves with approved joint compound or acoustical sealant for gypsum board assemblies.

F. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units and counter flashing applied in coordination with roofing work. Coordinate all work with roofing system to maintain roof warranty.

G. Exterior-Wall and Floor Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal system. Size sleeves to allow for manufacturer recommended annular clear space between raceway or cable and sleeve for installing sleeve-seal system. Where sleeves are installed in core drilled openings, grout sleeve into the opening.

H. Where sleeves are installed exposed in finished spaces, provide metal escutcheon plates of size to match the sleeve.

I. Sleeve-Seal-System:

1. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
2. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.9 ELECTRICAL SYSTEM FIRESTOPPING INSTALLATION

A. Install firestopping at all penetrations of fire-rated assemblies. Comply with requirements in Division 07 and as outlined below.

B. Coordinate location and proper selection of firestop devices with fire rated assembly. Ensure cast-in place devices are installed before placement of concrete.

C. Install firestop materials in accordance with UL Fire Resistance Directory and manufacturer’s instructions.

D. Affix permanent label to each side of penetration immediately adjacent to firestopping to communicate to futures installers and code authorities the following:
1. Fire-stop product/system used
2. Installation Company
3. Penetration Hour Rating
4. Installation Date

E. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas. Keep areas of work accessible until inspection by applicable code authorities.

3.10 PAINTING

A. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS

SECTION 26 05 05 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This section covers all demolition, restoration, and salvage required to perform the electrical work indicted on the drawings, specified and/or as required to complete the project. It is the intent of this section of work to remove all existing electrical equipment, materials, etc. which are not required for the completed building and to restore any and all finished surfaces to their original type and conditions. To accomplish these requirements, the Contractor(s) shall, at his own expense, engage the services of others already performing finish work on this project. All work shall be completed to the satisfaction of the Architect/Engineers whose decisions shall be final. This requirement shall apply to all restoration work whether indicated or specified.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and re-installed.

B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, clean and prepare for reuse, and reinstall where indicated.

C. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to the removed, removed or salvaged, or removed and reinstalled.

D. Demolish: Completely remove and legally dispose of off-site.

E. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

F. Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.4 SUBMITTALS

A. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

B. Pre-demolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by selective electrical demolition operations. Submit before the Work begins.

1.5 MATERIALS OWNERSHIP

A. Except for items or materials to be reused, salvaged, reinstalled, or otherwise indicated to remain the Owner’s property, demolished materials shall become the Contractor’s property and shall be removed from the site with further disposition at the Contractor’s option but in compliance with ordinances and regulations related to the materials being disposed.

1.6 PROJECT CONDITIONS

A. Building will be occupied during construction. Localized areas to be demolished will be vacated during demolition work. Conduct selective electrical demolition so Owner's operations will not be disrupted.

B. Corridors immediately adjacent to the demolition areas will be occupied. Conduct demolition so that access to and between occupied areas will be maintained.

C. On-site storage or sale of removed items or materials is not permitted.

1.7 COORDINATION

A. Demolition schedule shall not interfere with Owner’s on-site operations and operations of adjacent occupied buildings.

B. Prior to beginning demolition, arrange a conference with the Construction Representative to review electrical demolition scope, procedures, schedule, and items to be salvaged for the Owner.

C. Review requirements of General Demolition Contractor and work performed by other trades that rely on demolition of electrical circuitry or equipment to allow for structural demolition or removal of equipment.

D. Review areas where existing electrical circuitry and/or equipment is to remain in place and requires protection.

1.8 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notifications regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 2 - PRODUCTS

A. NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION AND RECORDING OF EXISTING CONDITIONS

A. Contractor is responsible for submitting photos and documenting existing conditions to Owner prior to commencing demolition. Systems and equipment found to be defective after demolition has commenced shall be repaired or replaced by Contractor at no additional cost to Owner.

B. Notify Construction Representative of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged. Use photographs to document conditions.

3.2 PROTECTION

A. Comply with governing laws, codes, and regulations governing fire protection and environmental protection during electrical demolition operations.

B. Existing Utilities: maintain existing utilities and building services and protect from damage during demolition operations.

1. All adjacent areas need to remain in operation and services to other areas outside area of construction need to be maintained during demolition.
2. Disconnect electrical power and communications only to the items of equipment or the panelboard that is identified for removal under the selective electrical demolition scope.
3. Provide temporary services during interruptions to existing utilities or building services as acceptable to Owner and Authorities Having Jurisdiction.

C. Protect lighting fixtures, exit signs, fire alarm devices, communications devices, etc. that are to remain in place from damage during demolition and construction operations. Exposed fixtures and devices shall have a plastic bag or other suitable covering affixed over the item to protect from dust and paint splatters.

D. Provide and maintain temporary partitions, dust control barrier, and ventilation per owner’s dust control plan.

E. Temporary enclosures and protection shall be removed by the Contractor upon completion of the electrical demolition work unless otherwise directed by the Construction Representative.

3.3 GENERAL REQUIREMENTS

A. Demolish and remove existing construction in the area of work to the extent required by new construction unless noted otherwise.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials so as not to void existing warranties.

C. Where electrical fixtures, equipment or other materials are removed and/or relocated, all abandoned conduit and conductors shall be removed in exposed areas. In concealed areas, materials shall be labeled and abandoned in place or removed as indicated and patch all openings.

D. The Contractor shall be responsible for the removal and/or relocation of any electrical equipment, fixtures, devices, appurtenances, etc. which may, in the course of construction, interfere with the installation of any new and/or relocated Architectural, Mechanical, Electrical, Structural or Fire Protection Systems whether indicated or not.

E. Where components of any system in this contractor's scope of work are to be reused, the contractor shall test those components prior to removal and record the state of functionality and condition of the components as tested. These records shall be provided to the owner or engineer upon request. In the absence of these records, all components removed shall be assumed functional at the time of removal. Any device subsequently found to be non-functioning or in unsuitable condition for reuse shall be replaced at the expense of the contractor.

F. At concealed spaces, such as hollow walls, ducts, and pipe interiors, verify condition and contents of hidden space before starting electrical demolition operations.

G. All hanger and support material for demolished piping and conduit shall be removed back to the primary structural support member. Grind connection to primary member smooth and touch up with paint to match adjacent surface.

H. Conduit containing circuits which are to be retained shall remain in place, unless otherwise indicated or required.

I. Wiring for existing circuits which must be rerouted, or which are partially abandoned, shall be reconnected to service the outlets/loads remaining on the circuit.

J. All wiring for a circuit which is to be removed or abandoned shall be removed back to the panel which supplied the circuit.

K. All open conduit knockouts, holes or unused hubs in electrical boxes and enclosures shall be properly plugged with suitable blanking devices that maintain the NEMA rating of the box or enclosure.

3.4 PATCHING AND REPAIRS

A. Unless otherwise indicated, the Contractor shall be responsible for the patching and repairing of all holes, etc. in the ceiling, wall, and floors where electrical equipment is removed.

B. All damages to buildings, utilities, and services to remain in place shall be promptly repaired at no cost to the Owner.

C. Where an existing utility or building service is interrupted, the contractor shall work continuously, providing premium time, to repair and restore service.

D. Neatly cut openings and holes plumb, square and true to dimensions, required.

E. Demolish concrete and masonry in small sections, cutting at junctures with construction to remain.

F. Use cutting methods least likely to damage construction to remain or adjoining construction. To minimize disturbance of adjacent surfaces, use hand or small power tools designed for sawing or grinding, not hammering, and chopping. Temporarily cover openings to remain.

G. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

H. All holes or openings in floors, walls or ceilings resulting from electrical demolition shall be properly sealed with material similar to the adjacent surface/finish.

1. Patch holes in concrete floors and ceilings where conduits are removed using non-shrink epoxy grout or concrete material to match existing surfaces and construction.
2. Patch holes in walls and partitions where conduits are removed to match existing construction and finish.

I. All rough edges of openings created by electrical demolition shall be promptly patched to create a finished surface.

J. Maintain the fire rating of all floors, walls, partitions, and ceilings when patching.

3.5 SALVAGED ITEMS

A. Items noted to be salvaged shall be cleaned, packed, or crated with contents identified on the container. The items shall be stored in a secure area until delivery to Owner. Transport items to storage area designated by Owner. Protect items from damage during transport and storage.

3.6 RE-INSTALLED ITEMS

A. Items noted to be removed and re-installed shall be carefully removed, cleaned, and repaired to functional condition adequate for intended reuse.

B. Pack or crate items after cleaning and repairing with contents identified on the container. Store and protect items from damage.

C. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment.

D. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.7 EXISTING ITEMS TO REMAIN

A. Protect construction indicated to remain against damage and soiling during selective electrical demolition.

B. When permitted by Construction Representative, items may be removed to a suitable, protected storage location during selective electrical demolition and reinstalled in their original locations after selective electrical demolition operations are complete.

3.8 DISPOSAL

A. Transport demolished materials off Owner’s property and dispose of legally in accordance with Federal, State, and local laws and regulations.

B. Lamps: Legally dispose of lamps in accordance with EPA guidelines.

1. Contractor shall be responsible for the careful removal of all lamps and fluorescent tubes without breakage from existing lighting fixtures.

2. Lamps removed from fluorescent, metal halide, mercury vapor, and sodium fixtures that do not have green end caps shall be placed by the Contractor in cardboard boxes. The Contractor shall label each box with type and quantity of lamps in each box and seal the box. Boxes shall be properly disposed of.
3. Broken, fluorescent, metal halide, mercury vapor, and sodium lamps without green end caps shall be immediately and carefully cleaned up by the Contractor, placed in a 55 gallon steel drum and properly disposed of by the Contractor

3.9 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SELECTIVE SEMOLITION FOR ELECTRICAL

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wire and cable rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.
3. Control Voltage Conductors and Cables

B. Related Requirements:

1. Refer to Division 27 for requirements related to balanced unshielded twisted pair (UTP) cabling.

1.3 REFERENCES

A. Abbreviations

1. RoHS: Restriction of Hazardous Substances.

B. Definitions

1. Low Voltage: Circuits and equipment operating at more than 50VAC but less than 1000VAC for building electrical distribution systems.
2. Control Voltage: Circuits and equipment operating at less than 50VAC for remote-control and signaling power-limited circuits.
3. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.
4. Homerun: The run of raceway(s) and cable(s) between the panelboard or switchboard and the junction box in the area served where branch circuit cables originate.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

2.2 BUILDING WIRE AND CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alpha Wire Company.
2. Cerro Wire LLC.
3. Encore Wire Corporation.
4. General Cable Technologies Corporation.
5. Okonite Compony.
6. Southwire Company.

B. Building Wire Description: Flexible, insulated, and uninsulated, drawn current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Cable Description: A factory assembly of one or more current-carrying insulated conductors in an overall protective sheath.

D. General Requirements:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

E. Copper Conductors: 98% conductive annealed copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Conductor Insulation:

1. 600V, 90°C
2. Comply with ANSI/NEMA WC 70/ICEA S-95-658.
3. THHN/THWN-2: Comply with UL 83.
4. XHHW-2: Comply with UL 44.

G. Variable Frequency Drive (VFD) Cable, Type TC-ER

1. Comply with UL 1277 and 2277
2. 1000V flexible motor supply cable, 90°C
3. Conductor Insulation: RHW-2.
4. Oversized crosslinked polyethylene insulation (XLPE), spiral-wrapped foil plus 85 percent coverage braided shields with insulated full-size ground wire and sunlight-and oil-resistant outer PVC jacket.

2.3 SPLICING DEVICES & CONNECTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. 3M; Electrical Products Division.
2. AFC Cable Systems, Inc.
3. Burndy
4. Gardner Bender.
5. Hubbell Power Systems, Inc.
6. Ideal Industries, Inc.
7. ILSCO.
8. NSi Industries LLC.
9. O-Z/Gedney;
10. Thomas & Betts.
11. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Material: Tin plated copper

D. Twist-On Wire Connectors: spring pressure type, 600V, 105°C insulation, capable of connecting two or more wires up to #8 AWG in a pigtail application.

E. Crimp Sleeve Splices: butt or parallel crimp type, copper sleeve with nylon cover and skirted insulators, capable of permanent connection of two or more wires up to #10 AWG.

F. Compression Splices: standard or long barrel type, 90°C, with cold shrink tubing, for use with hydraulic crimping tool, capable of permanent connection of wires #6 AWG and larger.

G. Ring or Flanged Fork Tongue Terminals: crimp type, 600V, 105°C insulation, insulated serrated barrel, capable of terminating wires up to #10 AWG.

H. No aluminum splicing devices or connectors are permitted.

2.4 CONTROL VOLTAGE CONDUCTORS AND CABLE

A. Control Cable: NFPA 70, Type CMG or CMP

1. Single or Multi-pair, twisted, minimum No. 18 AWG, stranded tinned copper conductors.
2. PVC insulation.
3. Shielded or Unshielded.
4. Flame Resistance:
   a. CMG: Comply with UL1685
   b. CMP: Comply with NFPA 262

B. Class 1, 2, and 3 Control Circuits: Stranded Copper, Type THHN/THWN-2

PART 3 - EXECUTION

3.1 CONDUCTOR AND INSULATION APPLICATION

A. Feeders and Branch Circuits: Copper. THHN/THWN-2. Solid for #10 AWG and smaller; stranded for # 8 AWG and larger.

1. Provide XHHW-2 insulation for circuits routed exposed on rooftops.

B. Conductors for motors or vibrating or oscillating equipment: Extra flexible stranded.

C. Cord Drops and Portable Appliance Connections: Type SOOW, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

D. Conductor sizes indicated on drawings are based upon 75 degree C rating.

E. Minimum branch circuit or feeder size:
1. Not less than #12 AWG copper wire unless noted otherwise.

F. Minimum control circuit conductor sizes:
1. Class 1 remote-control and signal circuits; No 14 AWG.
2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG

G. Provide all wire for the project in new and undamaged condition. Deliver in standard coils or reels. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable.

3.2 EXAMINATION

A. Prior to installing conductors and cables:

1. Verify that raceway installation is complete according to Section 260533 “Raceways and Boxes for Electrical Systems” and ready for installation of conductors and cables.
2. Verify that raceways are properly sized in accordance with NEC.
3. Visually inspect exposed raceways to ensure that raceways are not damaged, and bends are not deformed.
4. Verify that raceways do not exceed the maximum number of bends between pull-points.
5. Verify raceways have been cleaned of all dirt and debris.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Pulling Conductors in Raceways

1. Pull cables in accordance with cable manufacturer and pulling equipment manufacturer recommendations as well as applicable sections of the National Electric Code.
2. Use installation equipment, tools, and materials as necessary, such as sheaves, pulling eyes, basket grips, winches, cable reels and/or cable reel jacks, duct entrance funnels, and pulling tension gauges, and approved pulling lubricants where required to facilitate cable pulling without damage to cables or raceway.
3. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not use lubricants that harden or

become adhesive with age. Apply lubricant where cables enter ducts and conduits and at all intermediate access points on long or difficult pulls.

4. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values. Utilize special remote readout equipment to ensure compliance.
5. Avoid abrasion and other damage to cables during installation. Provide physical protection of cables, such as using appropriately sized flexible cable guides or feed-in tubes, at the entrance of boxes and raceways.
6. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

B. Bend Radius

1. Handle conductors and cables carefully. Make bends in cables and conductors such that cables, conductors, sheaths, armor, etc., are not damaged.
2. Do not bend conductors and cables to less than the NEC and manufacturer recommended minimum bending radius.
3. Ensure that tools and accessories used to install conductors and cables, such as rollers, sheaves, trolley assemblies, tube guides, and/or raceways, are properly sized and utilized to be greater than the minimum bending radii of conductors and cables.
4. Minimize bending where conductors and cables enter or exit raceways, cabinets, and boxes. Do not install cables that have been bent or kinked to a radius less than the recommended dimension.
5. Install conductors only after insulating bushings are in place.

C. If multiple circuits are pulled in a single homerun, provide a dedicated neutral for each phase conductor. In these cases, a maximum of seven conductors (six current carrying and one ground) are permitted in a single conduit except for switch legs and travelers in multi-point switching arrangements. De-rate conductors per NEC.

D. Multi-wire branch circuits with a shared neutral are not permitted unless specifically noted on the drawings. Where indicated, group the phases and neutral together with cable ties in the panelboard and in all pull boxes.

E. Install conductors for isolated power systems in as short a run of conduit as practicable. The use of pulling compound or lubricant is not permitted on conductors in isolated power systems.

F. Voltage Drop:

1. Adjust conductors and conduit sizes accordingly based on actual field installed conditions.
2. Size and Install all feeders and branch circuits for a maximum 2% voltage drop in feeders and 3% in branch circuits with a maximum total voltage drop of 5%.
3. Calculate using a load equal to 80% of the supply breaker rating unless the circuit breaker is rated to carry 100% of the load.
4. Where the conductor length from the panel to the first outlet on a circuit exceeds the values below, adjust branch circuit conductors from the panel to the first outlet. Increase the conductor size of remaining branch circuit as needed to meet above voltage drop limitations.
   a. For 277VAC homeruns exceeding 125-feet, #10 AWG minimum
   b. For 120VAC homeruns exceeding 50-feet, #10 AWG minimum
   c. For 120VAC homeruns exceeding 100-feet, #8 AWG minimum

G. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

H. Install cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours.

I. Bundle cables where run in groups using listed supports. Provide independent supports directly from structure, do not route through structure or on work of other trades.

J. Metal Clad Cable, Type MC

1. The use of metal clad cable is not permitted, except for connections to ceiling mounted recessed and semi-recessed luminaires concealed in accessible ceiling where the maximum length is limited to 72-inches.

K. Control Circuit Conductors and Cables

1. Use insulated spade lugs for wire and cable connection to screw terminals.
2. Conductors installed within environmental air plenums shall be per NEC. Article 800 and other applicable codes, with FEP-type insulation or an approved equivalent. Provide plenum-rated cable supports where plastic straps or other supports, etc., are installed in plenum areas.
3. Where indicated, systems and control conductors that are installed exposed shall not be routed across ceilings or ductwork. Provide independent supports anchored to building structure or other permanent support members.
4. Install in such a manner as to not interfere with the access to or operation of equipment or removal of ceiling tiles.
5. Nylon tie-wraps shall be installed in such a manner so as to bundle conductors neatly, allowing runouts of single conductors or groups to drop down to equipment served.
6. Install grommets where dropping out of trays or into panels or service columns.
7. Install sleeves with bushings where penetrating partitions.
8. Provide firestopping for penetrations of fire rated assemblies with approved materials.

3.4 SPLICES, TAPS, CONNECTIONS, AND TERMINATIONS

A. Prepare cable in accordance with the conductor, cable, splice and termination component manufacturers' recommendations and instructions.

B. Cut conductors and cables using tools and methods which ensure a square cut. Do not nick or damage conductors.

C. Ensure conductor inserts fully into the connector or termination with the insulation fitting closely to the connector or termination.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, a calibrated torque tools shall be used to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

E. Splices and Taps

1. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
2. Make splices and taps in junction boxes or other enclosure approved for the wiring method.
3. For conductors #10 AWG and smaller conductors, use pressure crimp type connections.
4. For conductors #8 AWG and larger, use a hydraulic compression type connection, with cold shrink tubing and tape to restore full insulation value of the wire being spliced.

F. Connections and Terminations
1. Ensure that conductor temperature and ampacity ratings are compatible with connectors, terminals, and equipment to which they are to be connected.
2. Provide crimp-applied ring or flanged fork type terminals for motor and equipment terminals where such terminals are provided on motor and equipment leads or on all stranded wire terminations using #10 AWG or smaller conductors.
3. Motor Connections shall use connection lugs with motor stub splice insulators.

G. Wiring at Outlets: Install conductors at each outlet with at least 12 inches of slack.

H. All cables and wiring, regardless of voltage, installed in manholes or cable vaults shall be routed in such a manner to provide a minimum of 10 feet of slack cable for future splicing. Install cables along walls by utilizing the longer route from entry to exit. If both routes are symmetrical, provide a loop of cable secured to wall. All cables shall be tied to insulated cable supports on wall-mounted racks, spaced a maximum of three feet apart.

3.5 PROTECTION

A. Intentional or unintentional painting of exposed low-voltage and/or control-voltage cabling insulation is prohibited. Ensure that exposed cabling is adequately protected from direct painting or overspray whether painting is required within the electrical specifications or required by other disciplines/trades.

B. Review the project's painting requirements for all disciplines and provide protection as required.

C. Where exposed cabling is being installed in exposed ceiling or wall spaces that are required to be painted, provide cabling in enclosed raceways, or provide alternate options for cable colors to engineer for approval.

3.6 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

1. All conductors shall be identified by means of labels placed on conductors in all junction boxes and at each terminal point with labels indicating source, circuit number or terminal number.
2. Identify each spare conductor at each end with identity number and location of other end of conductor and identify as spare conductor.
3. Identify each control voltage conductor or cable on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

B. Conductors, in all sizes of cable, shall have continuous solid insulation color(s) from the manufacturer. Taped ends shall not be acceptable.

1. Conductors shall be color coded as follows:
   a. 120/208 Volt Conductors
      1) Phase A: Black
      2) Phase B: Red
      3) Phase C: Blue
      4) Neutral: White
      5) Ground: Green
      6) Isolated Ground: Green/Yellow
   b. 277/480 Volt Conductors

1) Phase A: Brown
2) Phase B: Orange
3) Phase C: Yellow
4) Neutral: Gray or White with Brown tracer
5) Ground: Green
6) Isolated Ground: Green/Yellow

c. Note: Further identify isolated power conductors with ½" wide purple tape at all terminations and junctions.

2. Control voltage wiring color coding shall be consistent throughout the project and shall match existing equipment and standards where applicable. Color coding for each system shall be unique.
3. Conductors within enclosures that may be energized when enclosure disconnect is off - yellow or taped with 1/2" yellow tape every 6" of length, inside enclosure. Provide lamacoid plate warning sign on front of enclosure where this condition occurs.
4. DC Wiring:
   a. Positive: Light Blue
   b. Negative: Dark Blue

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Visual Inspections:

1. Compare cable data with drawings and specifications.
2. Inspect exposed sections of cable for physical damage and correct connections in accordance with drawings.
3. Inspect bolted electrical connections for high resistance. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data.
4. Inspect compression-applied connectors for correct cable match and indentation.
5. Inspect for correct identification and arrangements.
6. Inspect cable jacket insulation and condition.

C. Electrical Tests:

1. Perform insulation resistance testing for all electrical distribution system feeders unless notes otherwise. Testing may be witnessed by the Engineer and/or Commissioning agent. Schedule all tests with Architect with sufficient notice.
2. Insulation resistance tests shall be performed at a DC voltage of 1,000 volts for 600 volt rated equipment, and at a DC voltage of 500 volts for 120-300 volt rated equipment. Test duration shall be one minute. Minimum acceptable (temperature corrected) resistance is 25 megaohms for 120-300 volt rated equipment and 100 megaohms for 600 volt rated equipment and wiring.
3. Test instruments shall be calibrated to national standards within the last 12 months.

D. Test and Inspection Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

E. Cables will be considered defective if they do not pass tests and inspections. Remove and replace malfunctioning units and retest as specified above.

F. Submit test results to Architect and Engineer for approval

END OF LOW VOLTAGE ELETRICAL POWER CONDUCTORS AND CABLES

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Grounding and Bonding for electrical systems covers several different but interrelated systems including Electrical System Grounding, Equipment Grounding System, Grounding Electrode System, and interfaces with telecommunications bonding infrastructure as well as lighting protection systems.

B. Section includes requirements for electrical system and equipment grounding, plus the following special applications:

1. Underground distribution grounding.
2. Grounding electrodes.
3. Ground bonding common with lightning protection system.

C. Related Requirements:
1. Refer to Section 270526 “Grounding and Bonding for Communications Systems” for requirements associated with the telecommunications bonding infrastructure.

1.3 REFERENCES

A. Abbreviations

1. MGB: Main Grounding Busbar

B. Definitions

1. Grounding: Establishing a direct or indirect connection to Earth or some conducting body that serves in place of Earth.
2. Bonding: Method by which all non-energized conductive materials are effectively interconnected to create a low impedance path.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA)
   a. NECA 331 – Standard for Building and Service Entrance Grounding and Bonding

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Coordination Drawings: Plans showing dimensioned locations of grounding electrodes, test wells, and other grounding features.

C. Field quality-control reports. Provide test reports for each test specified in the field quality control section. Include copies of current equipment calibration certification.

D. Closeout Submittal:
1. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
    a. Instructions for periodic testing and inspection of grounding systems and features based on NETA MTS and NFPA 70B.
        1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
        2) Include recommended testing intervals.
3. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
    a. Test wells.
    b. Grounding electrodes and connections.
    c. Grounding arrangements and connections for separately derived systems.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

B. Comply with NFPA 70 and UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS:

A. Subject to compliance with requirements, provide products by one of the following:
1. ABB Blackburn
2. Eaton B-Line
3. Harger
4. Hubbell Burndy
5. Ilsco
6. nVent Erico
7. Panduit
8. VFC Lyncole

2.3 CONDUCTORS

A. Insulated Copper Conductors: Comply with Section 260519 “Low-Voltage Electrical Power Conductors and Cables”.

B. Bare Copper Conductors:

1. Solid Conductors: ASTM B 3.
2. Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

C. Straps/Jumpers: Copper tape, braided conductors pre-terminated with copper ferrules, cross-sectional area no less than a No. 6 AWG conductor.

2.4 ELECTRICAL SYSTEM BUSBARS

A. Grounding Busbar: Predrilled rectangular bars of annealed copper, minimum 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Size busbar length to accommodate initial conductor installation plus a 50% growth factor. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 1000 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.5 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits consisting of graphite molds, copper oxide and aluminum weld metal, and electronic ignition system. Provide types recommended by kit manufacturer for materials being joined and installation conditions.

C. Irreversible Compression Connectors: Tin-plated copper, for installation using a hydraulic compression tool and die matched to connector type. Provide with die code or other visual indicator to ensure proper connector selection and uniform compression for a permanent connection.

1. Taps: C-type, H-type, or Figure 6/8 type.
2. Splices: Long Barrel straight or tee.
3. Terminals: Two-hole lug long barrel type.

D. Mechanical Connectors: Tin-plated high strength copper alloy or high strength cast bronze
1. Water Service Pipe Clamps: Heavy-Duty, two-piece saddle type with stainless steel bolts.
2. Pipe Clamps: Heavy-Duty, U-bolt type with silicon bronze hardware.
3. Lay-in Lug Connector: Heavy-Duty, open face lug with hex head set screw.

2.6 GROUNDING ELECTRODES

A. Ground Rods: 10 mil pure electrolytic copper coating with molecular bond to high strength steel core; 3/4 inch by 10 feet with chamfered end. Ensure ground rods are die-stamped near the top with the name and trademark of the manufacturer and the length in feet.

B. Chemical-Enhanced Grounding Electrodes: Self-contained, maintenance free system consisting of a 10-foot copper tube with drilled holes, straight or L-shaped, charged with nonhazardous electrolytic chemical salts. Basis of Design: Lyncole XIT.
   1. Termination: Factory-attached No. 4/0 AWG copper conductor at least 48 inches long.
   2. Backfill Material: Electrode manufacturer's recommended enhancement material.

C. Enhanced Composite Backfill: Electrically conductive, environmentally-safe, maintenance free backfill material with neutral PH properties that creates a stable, non-corrosive, low resistance connection between a grounding electrode and earth. Basis of Design: Erico Ground Enhancement Material (GEM).

D. Test Well: Lightweight polymer concrete, Tier 15 rated, non-slip cover, suitable for non-deliberate incidental traffic. 12-inch by 12-inch minimum, 12-inches deep unless noted otherwise, with “GROUND” legend unless noted otherwise.

PART 3 - EXECUTION

3.1 GENERAL

A. Bond grounding bus and all non-current carrying metallic parts of raceways systems and equipment to common ground in accordance with the National Electrical Code, NECA 331, as shown on the Contract Drawings, and in accordance with the requirements of the local authority having jurisdiction.

B. The size of the grounding and bonding conductors shall be not less than that given in Article No. 250 of the National Electrical Code, and/or as shown on the Contract Drawings.

C. Interconnect all grounding systems in or on the structure to provide a common ground potential.

D. Bond all outlet, junction, pull boxes, and enclosures to the equipment grounding conductor with a grounding pigtail.

3.2 APPLICATIONS

A. Conductors: Install solid conductor for #10 AWG and smaller, and stranded conductors for #8 AWG and larger unless otherwise indicated.
   1. Install bare conductors where not specifically identified as bare or insulated except where installed in conduit with associated phase conductors. Install insulated conductors in conduit with insulation of the same material as the associated phase conductors with which it is installed.
   2. Provide insulated conductors not exceeding No. 8 AWG in size with green colored insulation. Identify conductors larger than No. 6 AWG with 4-inch green tape at each termination and at all junction and pull boxes.

B. Underground Grounding Electrode Conductors: Install bare copper conductor, sized per NEC, or as indicated on drawings, whichever is larger.
   1. Bury at least 24 inches below grade or below the frost line depth, whichever is greater.
   2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Electrical System Grounding Busbar: Install in electrical rooms housing service equipment, and elsewhere as indicated to provide a common connection point for individual grounding electrode conductors and bonding jumpers.

1. Install bus horizontally, on insulated spacers 4 inches minimum from wall, 18 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
3. Provide green laminated plastic nameplate with 1/2" high white letters indicating function of ground bus (i.e. “Service Main Ground Busbar”).

D. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Connections: Mechanical connectors.
2. Underground and Exposed Exterior Connections: Exothermic welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Mechanical connectors.
4. Connections to Structural Steel: Exothermic welded connectors.
5. Connections to Busbars: Irreversible compression connectors.

3.3 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the neutral bus except where service equipment neutral and ground bussing complies with exceptions listed in the NEC. Install a main bonding jumper between the neutral bus and ground bus. Provide external grounding busbar and install grounding electrode conductor to interconnect main grounding busbar and neutral bus.

B. Where ground fault protection is installed, ensure interconnection of neutral bus and ground bus does not interfere with correct operation of fault protection.

3.4 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Transformers: Provide grounding in accordance with the NEC and the following:

1. System Bonding Jumper (SBJ): Install at the source enclosure between the grounded terminal (neutral) and the equipment grounding terminal.
2. Supply Side Bonding Jumper (SSBJ): Install wire type SSBJ to bond the source enclosure to the enclosure at the first disconnect or overcurrent protective device.
3. Grounding Electrode Conductor (GEC): Install at the source enclosure from the SBJ connection point to the building grounding electrode system.
4. Bonding Jumpers: Where the metal water piping and/or the metal structural steel building frame in the area served by the separately derived system are not used as a grounding electrode, provide bonding jumper to the GEC connection point at the source enclosure.
5. Equipment Grounding Conductor (EGC): Bond the EGC of the primary feeder to the equipment grounding terminal.

3.5 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements for utility equipment.

B. Exterior Pad-Mounted Equipment: Install a minimum of two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with

equipment by connecting them to underground grounding conductors and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.6 EQUIPMENT GROUNDING AND BONDING

A. Equipment Grounding Conductors: Install insulated equipment grounding conductors with all feeders and branch circuits. Provide conductors of the same wire/cable type as the ungrounded current carrying conductors.

B. Increase equipment grounding conductor sizes in accordance with NEC article 250 where ungrounded current carrying conductor sizes are increased to minimize voltage drop.

C. Provide all circuits with a dedicated equipment grounding conductor unless noted otherwise.

D. Provide an equipment grounding conductor to each outlet on circuits protected by a GFCI circuit breaker.

E. At all metallic outlet, junction and pull boxes, bond the equipment grounding conductor to the enclosure.

F. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

G. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

H. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

I. Metal Poles Supporting Outdoor Lighting Fixtures: Install a ground rod and a separate insulated equipment grounding conductor at each pole in addition to grounding conductor installed with branch-circuit conductors.

3.7 INSTALLATION

A. Grounding Electrode Conductors and Bonding Jumpers: Securely fasten and route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

1. Route conductors to maintain a downward or horizontal direction to ground with a minimum bend radius of 8-inches.
2. Protection: Install above grade conductors No 6 AWG or larger exposed to physical damage and all conductors smaller than No. 6 AWG in schedule 80 PVC conduit. Where

metallic conduit is required, bond each conduit end to the electrode or ground conductor as close to the openings as possible with a full-size conductor and bonding bushing to create an electrically parallel path.

3. Clearance: Maintain a minimum separation of 12-inches from open telecommunications cable groups.

B. Ground Rods: Auger 6 inch diameter hole to depth 6 inches shorter than the ground rod length. Drive rods a minimum of 12 inches into the bottom of the hole until tops are 12 inches below final grade. After installing connections, backfill around ground rod with enhanced composite backfill.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2. Except at test wells, use exothermic welds for all below-grade connections to ground rods.
3. For grounding electrode system at the service, install at least three rods spaced at least two-rod lengths from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole.

1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Chemical Enhanced Grounding Electrodes: Install in accordance with electrode manufacturer’s recommendations. Install test well at each chemical enhanced grounding electrode.

E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts. Install straps and jumpers such that it does not restrict movement of the structure to which it is connected.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes using a mechanical connector. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Other Metal Piping: Bond each aboveground portion of metal piping systems, including gas piping, downstream from its equipment shutoff valve in an accessible location.
4. Except for water piping, do not utilize piping systems as a ground path where dielectric fittings are utilized. Do not use bonding jumpers to bridge over such fittings.
5. Do not use underground portions of natural gas, flammable gas, or liquid fuel piping as grounding electrodes.

G. Grounding for Steel Building Structure:

1. Where the building's steel frame is made discontinuous by masonry breaks or expansion joints, provide an accessible No. 500 kcmil bare copper jumper with exothermic weld connections to bond steel sections together, making the steel frame electrically continuous. The installation of the bonding jumpers shall be reviewed by the Engineer before covering.
2. Provide a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

H. Concrete-Encased Grounding Electrode (Ufer Ground): Provide and fabricate in accordance with NFPA 70; use a minimum of 20 feet bare copper conductor no smaller than #4 AWG located in building footing that has direct contact with earth.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts using exothermic weld connections. Extend grounding conductor below grade and connect to building's ground ring or to grounding electrode external to concrete.

I. Exothermic Welded Connections: Provide in kit form and selected for the specific types, sizes, and combinations of conductors and other items to be connected.

1. An electronic ignition system shall be used, and weld metal shall be a self-contained, sealed system with a bi-metallic fuse to start the reaction.
2. Comply with AWS Standards and manufacturer's instructions for procedures, appearance, and quality of welds; and methods used in correcting welding work.
3. Ensure process joins all strands and does not cause the parts to be damaged or weakened.
4. Completed connection or joint must be equal or larger in size than the conductors joined and have the same current-carrying capacity as the largest conductor.

J. Mechanical Connections: Install mechanical connections in accessible locations.

1. Tighten connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values.
2. Where manufacturer's torquing requirements are not indicated, tighten connections to comply with tightening torque values specified in UL 486A to assure permanent and effective grounding.

K. Connections between Dissimilar Metals: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Clean surfaces and apply anti-oxidant compound prior to installation of connections.
2. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
3. Make connections with clean, bare metal at points of contact.
4. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
5. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.8 FIELD QUALITY CONTROL

A. Buried or concealed grounding electrode systems shall be accepted by Engineer and Owner Representative before backfilling or covering.

B. Tests and Inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Bond Resistance Test: Test the bonding connections of the system using a certified micro-ohmmeter, taking two-point resistance measurements across each bond in the grounding electrode system. The maximum acceptable value of each bond is 0.5 milliohms.
3. After completing installation of the grounding electrode system and finished grade, but before permanent electrical circuits have been energized, test for compliance with requirements.
4. Grounding Electrode Resistance Test: Test completed grounding electrode system at service disconnect enclosure grounding terminal and at ground test wells using a manufacturer calibrated and certified 3-point ground resistance tester.

    a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by three-point fall-of-potential method according to IEEE 81.
    c. Disconnect and isolate the grounding electrode conductor from the electrical system at the main ground bus before testing.
    d. Install outer test probe outside the sphere of influence of the grounding electrode system. This value is typically 10 times the size of the grounding electrode system, between 300 and 500 feet from the main ground bus.
    e. Install inner test probe at 10 equally spaced intervals, in a straight line between the grounding electrode system connection and the outer test probe and note the resistance reading at each location.
    f. The resistance measurements taken from the flat part of the curve shall be averaged to determine the grounding electrode system resistance to earth.
    g. If large variations are noted in the resistance measurements, the outer test probe should be relocated further from grounding electrode system (outside its sphere of influence) to achieve some degree of flatness on the resistance curve.
    h. Excessive Ground Resistance: If resistance to ground exceeds 5-ohms, notify Engineer promptly and include recommendations to reduce ground resistance. If deemed necessary by the Engineer, additional electrodes shall be placed, and the measurement process repeated until the desired ground potential achieved.

5. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include test probe locations, observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare detailed test and inspection reports and submit to Engineer for review.

END OF GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 – General Requirements for Electrical Systems apply to this Section.

1.2 SUMMARY

A. This section is intended to specify the raceways, fittings, boxes, cabinets, specialties, and related items necessary to complete the work as shown on the drawings and specified herein.

B. Section Includes:

1. Metal conduits and fittings
2. Nonmetallic conduits and fittings
3. Surface metal raceway
4. Metal wireways and auxiliary gutters.
5. Boxes, enclosures, and cabinets
6. Wall ducts and trench ducts.

C. Related Requirements:

1. Refer to Division 07 firestopping section and Section 260010 “General Requirements for Electrical Systems” for penetration firestopping requirements related to electrical pathways and boxes.
2. Refer to Section 270528 “Pathways for Communications Systems” for supplemental pathway requirements related to communications systems.

1.3 REFERENCES

A. Abbreviations

1. EMT: Electrical Metallic Tubing
2. FMC: Flexible Metal Conduit
3. GRC: Galvanized Rigid Steel Conduit
4. IMC: Intermediate Metal Conduit
5. LFMC: Liquid-tight Flexible Metal Conduit.
6. RAC: Rigid Aluminum Conduit
7. RMC: Rigid Metal Conduit

B. Definitions

1. Outlet: A point on the wiring system at which current is taken to supply utilization equipment.
2. Raceway: an enclosed channel designed for enclosing and protecting electrical, communications, and signaling wires and cables.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA)
   a. NECA 101 - Standard for Installing Steel Conduits (RMC, IMC, EMT)
   b. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)

2. National Electrical Manufacturers Association (NEMA)
   a. NEMA FB 2.10 - Selection and Installation Guidelines for Fittings for Use with Non-Flexible Metallic Conduit or Tubing (Rigid Metal Conduit, Intermediate Metal Conduit, and Electrical Metallic Tubing)
   b. NEMA FB 2.20 - Selection and Installation Guidelines for Fittings for Use with Flexible Electrical Conduit and Cable
   c. NEMA RV 3 - Application and Installation Guidelines for Flexible and Liquid-tight Flexible Metal Conduits

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Shop drawings: For custom enclosures, cabinets, or boxes.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

2.2 METAL CONDUIT AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit.
3. Anamet Electrical, Inc.
4. Calconduit
5. Electri-Flex Company.
6. Nucor Tubular Products.
7. O-Z/Gedney.
8. Picoma Industries.
9. Robroy Industries.
10. Southwire Company.
11. Thomas & Betts Corporation.
12. Western Tube and Conduit Corporation.

13. Wheatland Tube Company.

B. Electrical Metallic Tubing (EMT) and Elbows:

1. Comply with ANSI C80.3 and UL 797.

C. Galvanized Rigid Steel Conduit (GRC, RMC) and Elbows:

1. Comply with ANSI C80.1 and UL 6.
2. Zinc coating both inside and outside by means of hot-dip galvanizing.
3. Use only threaded fittings for GRC.

D. PVC Coated Galvanized Rigid Steel Conduit (GRC) and Elbows:

1. Comply with NEMA RN 1
2. Minimum 40 mil thick PVC exterior coating with overlapping sleeves protecting threaded joints.
3. Minimum 2 mil thick urethane interior coating.
4. Clear urethane coating over hot-dip galvanized threads.

E. Intermediate Metal Conduit (IMC) and Elbows:

1. Comply with ANSI C80.6 and UL 1242

F. Flexible Metal Conduit (FMC):

1. Comply with UL 1.
2. Continuous interlocked hot-dip zinc galvanized steel with smooth interior and exterior.
3. Suitable for dry locations.

G. Liquid-tight Flexible Metal Conduit (LFMC):

1. Comply with UL 360.
2. Continuous interlocked hot-dip zinc galvanized steel core with smooth interior and exterior.
3. Suitable for wet and dry locations, direct burial applications, and concrete encasement.
4. Sunlight resistant, flame retardant thermoplastic PVC jacket resistant to heat, oil, and chemical breakdown.

H. Metal Fittings

1. Comply with NEMA FB1 and UL 514B.
2. Listed and labelled for type of conduit, location, and use.
3. Fittings for EMT:
   a. Compression type, zinc-plated galvanized steel.
   b. Concrete-tight- or rain-tight, hardened steel locknuts, and nylon insulating throats.
4. Fittings for GRC and IMC:
   a. Threaded zinc plated steel.
   b. Concrete-tight- or rain-tight, nylon insulating throats.
5. Conduit Bodies:
   a. Material: gray iron or heavy copper-free cast aluminum
   b. Available in varying configurations with integral bushing and gasketed coverplate.
6. Expansion/Deflection Fittings: UL 651 listed, manufactured coupling accommodating 3/4-inch linear movement from normal and 30-degree angular movement in all directions
   a. Basis of Design: OZ/Gedney DX
   b. PVC or steel sleeve to match conduit type with neoprene jacket, rated for environmental conditions where installed.
   c. Integral braided copper bonding jumper.

7. Fittings for FMC and LFMC:
   a. LFMC: Tubular Steel, zinc-plated with gland nut, sealing ring, high tensile grounding ferrule, insulated throat, and body for liquid tight connection.
8. Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
9. “Kwik-Couple” type fittings are not permitted.
10. Indentation, set-screw, or die-cast fittings are not permitted.

I. Joint Compound for threaded conduit: UL 2419 listed for use in conduit assemblies and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.3 NON-METALLIC CONDUITS AND FITTINGS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Tube & Conduit
2. Cantex
3. Carlon
4. Heritage Plastics
5. National Pipe & Plastics
6. Prime Conduit

B. Rigid Polyvinylchloride (PVC) Conduit:

1. Comply with NEMA TC-2 and UL 651.
2. Sunlight resistant and suitable for use with 90 degree C conductors.
3. Type EPC-40 suitable for normal duty applications.
4. Type EPC-80 suitable for heavy duty applications.

C. Non-Metallic Fittings

1. Comply with NEMA TC 3 and UL514B.
2. Listed and labelled for type of conduit, location, and use.
3. Compatible with conduit type and material.
4. Solvents and Adhesives: as recommended by conduit manufacturer.

2.4 SURFACE MOUNTED METAL RACEWAY

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. Hubbell
2. Mono-Systems
3. Wiremold

B. Source Limitations: Obtain surface metal raceway, components, outlets, and fittings from single manufacturer.

C. Single and Multi-Channel Raceways:
1. Two-piece design with base and snap on cover complying with UL 5, suitable for use with electrical branch circuit wiring, data/voice network cabling, and low voltage wiring.
2. Material: Galvanized Steel

3. Finish: Manufacturer's standard enamel finish in color selected by Architect, suitable for field painting to match adjacent surfaces.
4. Size: Available in varying widths, selected to accommodate number of conductors and services indicated on drawings with a maximum of 40-percent fill.

D. For multi-channel configurations, provide integral divider separating raceway into equal compartments for power and low voltage wiring.

E. Fittings: Include clips, straps, couplings, elbows, tees, connectors, and bushings suitable for interconnecting raceway segments in various configurations. Fittings to overlap raceway and hide uneven cuts. Material and finish to match raceway.

F. Device Boxes: single and multi-gang configurations, suitable for mounting standard devices and faceplates. Material and finish to match raceway.

G. Device Plates: sized to match raceway width with openings suitable for mounting various standard power and communications devices. Material and finish to match raceway.

H. Device Brackets: suitable for mounting standard single or two-gang devices horizontally or vertically within large raceways.

I. Plugmold: steel surface metal raceway with integral Simplex NEMA 5-20R outlets spaced 12-inches on center or as indicated on drawings.

2.5 METAL WIREWAYS AND AUXILIARY GUTTERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton B-Line
2. Hubbell Wiegmann.
3. nVent Hoffman.
4. Square D.

B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise required by environmental application, and sized according to NFPA 70. Minimum of 14-gauge steel before finishes are applied.

C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

1. Provide knockouts on all runs, unless otherwise indicated or prohibited by codes.
2. Provide dividers to separate conductors of different insulation levels or where required by equipment vendor installation instructions.

D. Wireway Covers: Furnish with continuous hinged covers on all runs and removable covers on all fittings unless otherwise noted, to allow a continuous unobstructed path for conductor installation.

E. Finish: Manufacturer's standard enamel finish resistant to corrosion, moisture, and oil.

F. Size: available in nominal sizes 2-1/2-inch by 2-1/2-inch, 4-inch by 4-inch, 6-inch by 6-inch or 12-inch by 12-inch.

G. Install supports to allow unobstructed access to wireway interior. Use minimum 1/4-inch rod hangers for up to 4-inch by 4-inch wireway, 3/8-inch rod up to 8-inch by 8-inch wireway, and 1/2-inch rod for 12-inch by 12-inch wireway.

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Eaton Crouse-Hinds.
2. Emerson/Appleton Electric.
3. FSR Inc.
4. Garvin Industries
5. Hoffman.
6. Hubbell Killark.
7. Milbank Manufacturing Co.
8. Mono-Systems, Inc.
9. O-Z/Gedney.
10. RACO / Hubbell.
11. Stahlin Non-Metallic Enclosures.
12. Thomas & Betts.
13. Wiremold / Legrand.

B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets shall be listed for intended use.

C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, with gasketed cover.

E. Luminaire Outlet Boxes: Non-adjustable, designed for attachment of luminaires, listed, and marked for the maximum allowable weight with at least a 2.0 safety factor for the anticipated fixture weight.

F. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb.

G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1, constructed of code gauge, galvanized steel with sides formed and corner seams riveted or welded before galvanizing

H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. For box extensions and mud rings used to accommodate building finishes, provide with same material as recessed box.

J. Minimum Device Box Dimensions unless noted otherwise:

1. Single gang: 4-inches square by 2-1/8-inches deep with single gang extension ring.
2. Two gang: 4-inches square by 2-1/8-inches deep with two-gang extension ring.

3. Three gang: 8-5/8-inches by 4-1/2-inches by 2-1/2-inches deep with three gang extension ring.
4. Four gang: 10-7/16-inches by 4-1/2-inches by 2-1/2-inches deep with four gang extension ring.

K. Gangable boxes are prohibited.

L. Boxes assembled with sheet metal screws are prohibited.

M. Hinged Cover Enclosures: Comply with UL 50 and NEMA 250, suitable for installed environment with continuous-hinge cover and flush latch unless noted otherwise.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
2. Nonmetallic Enclosures: Fiberglass
3. Interior Panels: Steel, all sides finished with manufacturer's standard enamel.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Apply raceway products as specified below unless otherwise indicated:

1. Refer to Section 260543, "Underground Ducts and Raceways for Electrical Systems" for additional requirements related to raceways installed underground in trenches outside of the building footprint.
2. Exterior and Exposed: GRC
3. Concealed Underslab: GRC or PVC Type EPC-40 where approved.
4. Interior, Concealed in Ceilings, Walls, and Partitions: EMT, IMC, or GRC
5. Interior, Concealed in Concrete or Grouted Masonry Walls and Partitions: IMC or GRC
6. Interior, Damp or Wet Locations: GRC
7. Interior, Where exposed and Not Subject to Physical Damage: EMT, GRC, or IMC. Raceway locations include the following:
   a. Electrical Rooms
8. Interior, Where Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
   a. Loading dock.
   b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
   c. Mechanical rooms (below 8'-0").
   d. Gymnasiums.
9. Interior, where Exposed in washdown area and Subject to Severe Physical Damage: PVC Coated GRC. Raceway locations include the following:
   a. Exposed stub-ups in Commercial/Institutional Kitchen or Cafeteria.
10. Interior, where Exposed and subject to Corrosive Environment: RNC Type EPC-80 PVC. Raceway locations include the following:
    a. Pools and Natatoriums.
11. Hazardous (Classified) Locations: GRC
12. Conductors operating above 600V: GRC
13. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

14. Connection to ceiling mounted recessed and semi-recessed luminaires and electrical devices: FMC.
15. Boxes and Enclosures: NEMA 250, Type 1 except as follows:
    a. Damp or Wet locations: NEMA 250, Type 3R
    b. Commercial/Institutional Kitchens and Cafeterias: NEMA 250, Type 3R
    c. Corrosive environments: NEMA 250, Type 4X
16. Exposed Boxes subject to physical damage: Die cast metal boxes with threaded hubs.
17. EMT is not permitted underslab, embedded in concrete slabs, or where exposed to physical damage.
18. Non-metallic conduit is not permitted for the following applications unless approved by the Engineer:
    a. Interior Locations including environmental air plenums.
    b. Applications where a redundant ground fault path is required by code.
19. Flexible non-metallic conduit is not permitted.
20. Unless otherwise indicated on the drawings, intermediate metal conduit (IMC) may be used in any location in place of rigid galvanized steel conduit (GRC), where permitted by codes, and where approved by the Engineer.

C. Minimum Raceway Size: 3/4-inch trade size unless noted otherwise on the drawings.

D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
4. Flexible Conduit: Use only steel fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth or where prolonged contact with construction materials will degrade the aluminum.

F. Install raceways and fittings in a manner to avoid use of dissimilar metals that would result in galvanic action corrosion.

G. Install surface conduits or raceways only where indicated on Drawings.

H. Do not install surface conduits or raceways on exterior facades unless approved by Engineer.

I. Do not install nonmetallic conduit where ambient temperature or operating temperature of the conductors exceeds the rating of the raceway.

J. Conduit installed embedded in concrete slabs is not permitted.

3.2 RACEWAY INSTALLATION

A. Comply with requirements in Section 260500 "Common Work Results for Electrical Systems" for hangers and supports.

B. Comply with NECA 1, NECA 101, NECA 111 and manufacturer’s written instruction for installation requirements except where requirements on Drawings or in this article are stricter.

Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

C. Complete raceway installation before starting conductor installation.

D. Comply with utility company requirements for raceways and boxes containing utility company conductors.

E. Size raceways to conform with Annex C, of the National Electrical Code, unless otherwise shown on the Contract Drawings.

F. Level and square raceway runs and install at proper elevations and required heights. Hold tight to structure wherever possible, to maximize available space and not restrict other trades.

G. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated.

H. Install conduits with runs parallel or perpendicular to building lines, walls, structural members or intersections of vertical planes and ceilings, with right angle turns consisting of cast metal fittings or symmetrical bends unless otherwise shown. Randomly routed conduits are not acceptable.

I. Make bends in raceway using large-radius preformed elbows. Provide concentric bends for parallel runs of conduit. Conform with NFPA 70 minimum radii requirements for field bending. Use only equipment specifically designed for material and size involved.

J. Install no more than the equivalent of three 90-degree bends in any conduit run. Support within 12-inches of changes in direction.

K. Provide junction boxes or pull boxes so that conduit runs do not exceed 100 feet, or as shown on the Contract Drawings. Size junction boxes per NEC, Article 370.

L. Provide conduit supports spaced not more than 8-feet apart.

M. Support conduit within 12-inches of enclosures to which attached.

N. Do not drill into bar joists to support raceways or cables.

O. Install conduits at least 12-inches away from flues, steam, or hot water pipes.

P. Conduit installed below concrete slabs is permitted for feeders and for branch circuits serving floor outlets. Underslab conduit is prohibited for other locations unless noted on the drawings or with permission of the engineer. Where approved, comply with the following:

1. Locate raceway a minimum of 12-inches below the bottom of slab.
2. Provide minimum 2-inch spacing between conduits to ensure proper compaction of structural fill.
3. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
4. Transition underslab RNC to GRC for all bends larger than 20-degrees and for all stub-ups through a slab on grade. Arrange stub-ups so curved portions of bends are not visible above finished slab. Extend GRC stub-ups a minimum of 6” above the concrete slab. Schedule 80 PVC stub-ups are allowed where approved by engineer.
5. Seal around conduits when penetrating vapor barriers.
6. Where installed in corrosive soils, coat all underslab rigid steel conduit with two coats of bitumastic paint such as "Asphaltum".

Q. Where raceways are subject to environmental changes, locate seals immediately at the boundary so no fittings or boxes are between the seal and the change of environments that would allow migration of condensation within the raceway system. Seal the interior of all raceways at the following points:

1. Where conduits pass from cold to warm locations, such as boundaries of refrigerated spaces and at building wall and roof penetrations.
2. Where an underground service raceway enters a building or structure.
3. Conduit extending from interior to exterior of building.
4. Conduit extending into pressurized duct and equipment.
5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

R. Install conduits in a manner so as to ensure against collection of trapped condensation. Arrange all runs of conduit so as to be devoid of traps. Provide trapped conduit runs with explosion proof drains at low points.

S. At hazardous locations, install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed non-shrink sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.

T. Coordinate with other trades, including metal and concrete deck trades, as necessary to interface installation of electrical raceways and components.

U. Complete installation of electrical raceways before starting installation of cables or wires within raceways.

V. Take precautions to prevent the lodgment of dirt, plaster, or trash in all conduit or tubing, fittings, and boxes during construction. Use mandrel to clean all conduit for floor boxes or conduit below grade and ensure its swabbed free of debris or moisture before wiring is installed.

W. Unless using GRC, do not locate conduits, cables, raceways, and enclosures within 2 inches of bottom of metal-corrugated sheet roof decking, measured from the lowest surface of the roof decking to the top of the conduit, cable, raceway, or box.

X. Conduits, cables, raceways, and enclosures are not permitted in concealed locations of metal-corrugated sheet decking type roofing.

Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72-inches of flexible conduit for ceiling mounted recessed and semi-recessed luminaires, and 36-inches for all other equipment subject to vibration, noise transmission, or movement, and for transformers and motors.

1. Install as a single piece with clamp-on insulated throat connectors designed for the purpose.
2. Provide strain relief fittings where subject to vibration.
3. Provide an equipment grounding conductor and bonding jumper at all locations.
4. For LFMC, provide a minimum of 18-inches and loop to avoid restraining vibrating equipment.

Z. Stub-ups to Accessible Ceilings:

1. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or into an enclosure.
2. Where conduits terminate at a cable tray pathway, provide listed fitting to secure conduit to cable tray.

AA. Mechanically fasten conduit terminations at a wireway, provide metal insulated bushings, and bond to the wireway with bonding jumper.

BB. Furnish conduit bodies in proper configurations, avoiding excessive openings. Any openings that are left shall be properly plugged. Wiring splices within conduit bodies are not permitted.

CC. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

DD. Provide a completely separate raceway system, including junction boxes and pull-boxes, for each emergency power, optional stand-by, and normal power system for complete separation in accordance with NEC.

EE. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of secured slack at each end of pull wire. Secure pull string at each end and cap raceways.

FF. Coordinate with vendors and provide extra pull-strings as required to ensure sufficient number of pull strings.

GG. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.

HH. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines

1. Install raceways square to enclosures and terminate with appropriate fitting:
2. For enclosures without hubs, terminate with appropriate fitting, insulated throat liner, and case-hardened locknuts on both sides of enclosure wall.
3. Terminate rigid conduits with threaded hubs or with locknuts on inside and outside of enclosure and insulated throat metal bushing.
4. Install locknuts hand tight, plus one-quarter turn more.
5. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
6. All threaded fittings shall engage a minimum of seven full threads. Fasteners shall be properly torqued to manufacturer's recommendations.
7. Split sleeve insulators are not permitted.

II. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

JJ. Expansion-Joint Fittings:

1. Install expansion fittings at all locations where conduits cross building or structure expansion joints.

2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

KK. Where raceways penetrate rooms or walls with acoustical requirements, seal raceway openings on both sides of penetration with acoustically rated putty or sealant.

LL. Coordinate penetration elevation and spacing for all penetrations through high challenge fire walls so no penetration is located more than 36-inches above finished floor level.

MM. Surface Raceways:

1. Provide surface metal raceways where indicated on drawings or approved by the Engineer.
2. Provide all trim and cover fittings, flush feed boxes, splices, and outlet fittings necessary for a complete installation.
3. Provide multi service raceway with divider for locations that require power and low-voltage wiring.
4. Install surface raceway with a minimum 2-inch radius control at bend points.
5. Secure surface raceway with two-hole straps at intervals not exceeding 24-inches and within 6-inches of boxes, transitions, and turns. Provide no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
6. Provide box connector and junction box immediately above ceiling for transitioning raceway to conduit.

3.3 BOX AND ENCLOSURE INSTALLATION

A. Provide electrical outlets and enclosures as required for splices, taps, wire pulling, and equipment connections.

B. Provide pull boxes as required to maintain conduit run and bend limitations specified herein.

C. Size all outlets, pull boxes, junction boxes, cabinets, etc., per adopted edition of the National Electrical Code.

D. Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

E. Install interior and exterior outlet boxes recessed in building construction with face or cover flush with finished surfaces unless noted otherwise. Where outlet boxes are installed in walls of glazed tile, brick, concrete block, or in walls covered by wood wainscot or paneling, provide deep box to ensure the outlet boxes are installed straight and secure in walls.

F. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements and architectural elevations. Install boxes with height measured to center of box unless otherwise indicated.

G. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box. Do not split the mortar joint

H. Provided 3/4-inch rigid conduit pendants where lighting fixtures, appliances, or wiring devices are to be suspended from ceiling outlet boxes. Outlet boxes shall be malleable iron, provided with self-aligning covers with swivel ball joint and #14 gauge steel locking ring. Provide safety chain between building structure and housing for all fixtures, appliances, or devices greater than 10 lbs. weight. Install fixtures plumb and level. Cover pendants shall be finished to match fixtures.

I. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

J. Locate boxes so that cover or plate does not span different building finishes.

K. Provide spanner bars to support all boxes from more than one side by spanning two framing members.

L. Fasten boxes up to 4-11/16 square size to their mounting surface or support with two fasteners of proper size. Fasten larger sizes with four fasteners, minimum.

M. Support boxes recessed in ceilings independent of ceiling tiles and ceiling grid.

N. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits or ceiling support wires.

O. Provide all cabinets and boxes for NEMA 1 applications with knockouts, as necessary, or field cut with approved cutting tools which will provide a clean, symmetrically cut opening to maintain UL listing of enclosure.

P. Replace any unused knockouts or openings with a listed knockout closure.

Q. Coordinate with equipment vendors to provide special sized outlet boxes to support installed equipment.

R. Where boxes and enclosures are located in areas or on walls with acoustical requirements, seal openings and knockouts in back and sides of boxes with acoustically rated putty or sealant and provide gasket for wall plates and covers.

3.4 GROUNDING AND BONDING

A. Bond all metal boxes, junction boxes and pull boxes with pigtails to the equipment grounding conductor.

B. Provide insulated throat grounding bushings with appropriately sized bonding jumpers for the following locations to maintain electrical continuity between the raceway and enclosure:

1. Metal raceways and enclosures that contain service conductors.
2. Metal raceways and enclosures that contain grounding electrode conductors.
3. Where metal raceways containing circuits over 250V terminate in a concentric or eccentric knockout at cabinets, enclosures, or sheet metal pull boxes listed in accordance with UL 50.
4. Where the integrity of a concentric or eccentric knockout has been compromised.
5. Metal raceways and enclosures that contain feeders.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

B. Protect threads on conduits and fittings with plastic protectors or other means to prevent damage prior to installation.

C. Provide protection for all conduit stubbed through floor during construction with plastic caps approved for this purpose.

3.6 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

B. Identify all junction, outlet and pull boxes in data/mechanical/electrical rooms and above ceilings with panel and circuit designation on outside of covers. Identify all exposed junction, outlet and pull boxes in finished areas with panel and circuit designation on inside of covers.

3.7 PAINTING

A. Raceways installed in exterior locations shall receive one coat of primer, two coats finish paint after preparation of galvanizing, color selected by Architect.

B. Exposed raceways in painted interior areas shall be painted to match adjacent finishes.

END OF RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

SECTION 26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Direct-buried and concrete-encased conduits, ducts, and duct accessories.
2. Handholes and boxes.
3. Utility Structure accessories.

B. Related Requirements:

1. Refer to Section 260533 “Raceways and Boxes for Electrical Systems” for pathway requirements installed under building slabs.

1.3 REFERENCES

A. Abbreviations

1. GRC: Galvanized rigid conduit.
2. IMC: Intermediate metal conduit.
3. RNC: Rigid nonmetallic conduit.

B. Definitions

1. Backfill: Earth or other controlled material placed in trenches for filling and grading back to a finished state.
    a. Initial Backfill (encasement): Backfill placed beside and over conduit arrangements in a trench, including haunches to support sides of conduits.
    b. Final Backfill: Backfill placed over initial backfill to fill a trench.
2. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying conduit.
3. Duct: A single or multiple underground conduits encased in concrete or direct buried.
4. Duct Bank: An arrangement of two or more ducts installed together.
5. Encasement: Material placed around a duct or duct bank to provide additional protection.
6. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Manufacturers Association (NEMA):

a. NEMA TCB-2 “Guidelines for the Selection and Installation of Underground Nonmetallic Raceways”.

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Field quality-control reports including digital photographs of all concealed work.

C. Closeout Submittals

1. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", ensure all utilities, structures, and underground conduits are surveyed and recorded on as-built drawings.

1.5 FIELD CONDITIONS

A. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with IEEE C2 and NFPA 70.

2.2 CONDUITS AND FITTINGS

A. Comply with 260533 “Raceways and Boxes for Electrical Systems”.

2.3 DUCT ACCESSORIES

A. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and size of ducts with which used, and selected to provide minimum duct spacing indicated while supporting ducts during encasement or backfilling.

B. Fabric Innerduct: Continuous, nylon resin polyester, multi -pocket fabric innerduct, with internal pull tape. Maxcell or equal.

C. Pull Line: Flat, woven, polyester or polyaramid tape, low stretch, pre-lubricated for reduced friction. Strength suitable for required pulling tensions with a minimum of 200-lb. Muletape or equal.

D. Underground Detectable Warning Tape: Flexible tape constructed with solid aluminum foil backing and clear film laminate, 6-inches wide, 5-mil overall thickness.

1. Suitable for the method of installation and locating underground utility lines.
2. Chemically inert tape material and ink, resistant to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
3. Comply with APWA Uniform Color Code.
4. Inscriptions for Red-Colored Tapes: "CAUTION BURIED ELECTRIC LINE BELOW".
5. Inscriptions for Orange-Colored Tapes: “CAUTION BURIED COMMUNICATIONS LINE BELOW”.

E. Duct Sealants: Re-enterable, two-part, closed-cell urethane foam capable of sealing conduits with multiple cable configurations.

1. Capable of withstanding temperatures from -40 deg F to 200 deg F and holding 22 feet waterhead pressure continuous.
2. Chemically resistant to gasoline, oils, dilute acids, and bases.
3. Compatible with cable jacket and shall not affect the physical or electrical properties of wire and cable.
4. Workable at temperatures as low as 35 deg F.
5. UL94 Class HBF fire retardant rating.

2.4 POLYMER CONCRETE HANDHOLES AND BOXES

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Armorcast
2. NewBasis
3. Oldcastle
4. Hubbell Quazite

C. General Requirements:

1. Comply with SCTE 77. Minimum Tier 15.
2. Color: Gray.
3. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, as indicated for each service.

2.5 PRECAST CONCRETE HANDHOLES

A. Description: Factory fabricated, one-piece units and units with interlocking mating sections, complete with accessories, hardware, and features. Frame and cover shall have load rating consistent with that of structure.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Christy Concrete Products
2. Oldcastle
3. Utility Concrete Products
4. Utility Vault Co

C. Comply with ASTM C 858.

D. Precast reinforced-concrete, H-20 structural load rating according to AASHTO HB 17.

E. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.

1. Locate windows no less than 6 inches from interior surfaces of walls, floors, or roofs of structure, but close enough to corners to facilitate racking of cables on walls.
2. Provide window opening with cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
3. Provide window opening frame with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
4. Provide windows 1-1/2 to 2 inches thick.

F. Duct Entrances in Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.

1. Type and size shall match fittings to duct or conduit to be terminated.
2. Fittings shall align with elevations of approaching ducts and be located near interior corners of structures to facilitate racking of cable.

G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

H. Provide ventilation openings where indicated on drawings.

I. Frames, Covers, and Chimney Components: Comply with structural design loading specified for structure.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 35 cast iron with milled cover-to-frame bearing surfaces; diameter, 32 inches.
   a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
   b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
2. Cover Legend: Cast in. Selected to suit system.
   a. All covers shall be provided with 2 inch lettering and with the structure number, assigned by Owner, welded onto the cover if not provided by the manufacturer.
   b. All covers shall be provided with stainless steel drop handles.
3. Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
   a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.

b. Seal joints watertight using preformed plastic or rubber conforming to ASTM C 990. Install sealing material according to the sealant manufacturers' printed instructions.

J. Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.

K. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch diameter eye, and 1-by-4 inch bolt.
1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

L. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.

M. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.

N. Tested Ultimate Pullout Strength: 12,000 lbf minimum.

O. Ground Rod Sleeve: 3-inch, PVC conduit sleeve in floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.

P. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.

Q. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.
1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.

2.6 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C 1037.

B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by an independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of ducts, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Architect if there are obstructions or conflicts between areas of excavation and existing structures or archaeological features to remain.

B. Coordinate elevations of ducts and duct-bank entrances into handholes, and boxes with final locations and profiles of ducts and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct runs drain to handholes, and as approved by Architect.

C. All necessary precautions shall be taken by the contractor during construction to prevent the lodging of dirt, plaster or trash in all conduit, tubing, fittings and boxes.

3.2 UNDERGROUND DUCT APPLICATION

A. Apply underground duct products as specified unless noted otherwise:

1. Refer to Section 260533, “Raceways and Boxes for Electrical Systems” for additional requirements related to underground conduit below building slabs.
2. Ducts for Utility Company primary conductors: comply with utility company standards unless noted otherwise.
3. Ducts for Electrical Service Secondary Conductors: RNC, Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.
4. Ducts for Electrical Feeders 600 V and Less: RNC, Type EPC-40 PVC, in concrete-encased duct bank unless otherwise indicated.
5. Ducts for Electrical Branch Circuits: RNC, Type EPC-40 PVC, in direct buried duct bank unless otherwise indicated.
6. Ducts for Communications Cables: RNC, Type EPC-40 PVC, in direct buried duct bank unless otherwise indicated.
7. Underground Ducts 600V and less Crossing Driveways and Roadways: RNC, Type EPC-40-PVC, encased in reinforced concrete. Extend reinforcement a minimum of 5-feet beyond the edge of paved surfaces.

B. Minimum Cover Requirements: Provide reinforced concrete encasement where minimum depths are not achievable.

1. Electrical Primary or Conductors more than 600V: 48-inches unless otherwise indicated by utility company requirements.
2. Electrical Secondary Service and Feeders: 36-inches
3. Electrical Branch Circuits: 24-inches
4. Communications: 30-inches

C. Transition RNC to GRC for all stub-ups and building enclosure penetrations. Use fittings manufactured for RNC-to-GRC transition.

1. Arrange stub-ups so curved portions of bends are not visible above grade. Increase burial depth where required to maintain cover for curves and bends.
2. Do not use steel raceways for equipment stub-ups where prohibited by utility company standards.

D. Minimum Underground Raceway Size: 1-1/4 inch trade size unless noted otherwise on the drawings.

3.3 EARTHWORK

A. Contractor shall accept the site as they find it and remove all trash, rubbish, and material from the site prior to starting excavation work.

B. Subsurface Data

1. Subsurface investigations have been performed and the results provided with the contract documents. The information was obtained primarily for use in preparing foundation design. Each contractor may draw their own conclusions therefrom. No responsibility is assumed by the Owner for subsoil quality or conditions other than at the locations and at the time the investigations were made.
2. Materials to be excavated shall be unclassified, and shall include earth, rock, or any other material encountered in the excavation to the depth and extent indicated on the drawings and specified herein. No adjustment in the contract sum will be made on account of the presence or absence of rock, shale, or other materials encountered in excavating.

C. Benchmarks and Monuments

1. Carefully maintain all benchmarks, monuments, and other reference points. If disturbed or destroyed, replace as directed.

D. Excavation:

1. Remove rock by using hand or power tools only. Blasting is not permitted unless authorized in writing by the Architect.
2. Any damage to existing structures, exterior services, or rock intended for bearing shall be corrected by the Contractor at their own expense.
3. Take necessary precautions to control runoff of eroded earth onto the property of others or against the structures. All such damage or any other damage incurred in the course of excavation, shall be corrected by the Contractor at their own expense.

E. Trenching:

1. Cut trenches neatly and uniformly. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.
2. Width: Excavate trench a minimum of 3 inches wider than duct bank on each side with a minimum trench width of 12-inches.
3. Depth: Excavate to a minimum depth that equals ductbank height plus minimum cover requirements.
4. Hand excavate trench bottom to provide uniform bearing and support of conduits on an undisturbed subgrade matching slope requirement. Remove all debris, stones, and other projections.
    a. For rock or other unyielding soils, excavate trenches 6-inches deeper than required elevation and provide level 6-inch compacted sand bedding course.
    b. For unstable soils or where bedding course is subject to washout, provide concrete trench bottom.
5. Coordinate protection of roots in tree and plant protection zones with Division 31 requirements.

6. Keep trenches free from water while construction is in progress. Installation of conduit or cable in trenches with water is not permitted. Contractor is responsible for all costs associated with dewatering of trenches.

F. Final Backfill: Comply with Division 31 and as indicated below:

1. Use satisfactory soil to backfill trenches to final subgrade elevation unless required otherwise by Civil or Structural subgrade requirements.
2. Install final backfill in 6-inch layers.
3. Compact all backfill to 95% standard proctor density.
4. Mechanical means for compaction can be used once conduits have been covered with at least 12-inches of hand tamped backfill. Do not use heavy-duty, hydraulic-operated, compaction equipment.

G. Restoration:

1. Replace area immediately after backfilling is completed or after construction in immediate area is complete.
2. Restore all surface features at areas disturbed by excavation, storing of dirt, cable laying, and other work, and re-establish original grades unless otherwise indicated.
3. Restore vegetation and include 6-inches of clean topsoil, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32.

H. Cut and patch existing pavement in the path of underground ducts and utility structures according to the "Cutting and Patching" requirements in Division 01 and Section 260010, “General Requirements for Electrical”.

3.4 DUCT INSTALLATION

A. Install ducts, spacers, and accessories into ductbank configurations to accommodate duct quantities and sizes indicated on drawings.

B. Install ducts according to NEMA TCB 2.

C. Slope: Pitch ducts a minimum slope of 1:300 down toward handholes and away from buildings and equipment. Slope ducts from a high point in runs between two handholes, to drain in both directions. Install ducts in such manner to avoid traps and insure against collection of moisture.

D. Curves and Bends:

1. Use 5-degree angle couplings for small changes in direction.
2. Use manufactured long sweep bends with a minimum radius of 36 inches vertically and 60-inches horizontally, unless otherwise indicated.
3. Field manufactured bends are acceptable for a bend radius greater than 35-feet. Install field bends in accordance with NEMA TCB 2.
4. Electrical duct and duct banks: Install no more than the equivalent of three 90-degree bends in any conduit run.
5. Communications duct and duct banks: Install no more than the equivalent of two 90-degree bends in any conduit run and a maximum of 600 feet between pull points.

E. Joints: Use solvent-cemented joints in non-metallic ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same horizontal or vertical plane to ensure encasement or backfill fully surrounds each raceway.

F. Installation Adjacent to High-Temperature Steam Lines: Where duct banks are installed parallel to underground steam lines, provide minimum 6-foot separation, or perform calculations showing the duct bank will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct bank crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

G. Installation Adjacent to Other Utilities:

1. Provide minimum 12-inches of earth or 3-inches of concrete between power and communications ducts.
2. Provide minimum 24-inches of earth between power or communications ducts and other parallel utilities. At utility crossings, provide minimum 6-inches of separation except provide 12-inches separation where crossing utility is gas or other line that transports flammable material.
3. Do not locate power and communications ducts below water and sewer lines.

H. Duct Entrances to Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.

1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
2. Direct-Buried Duct Banks: Install an expansion and deflection fitting in each conduit in the area of disturbed earth adjacent to handhole. Install an expansion fitting near the center of all straight line direct-buried duct banks with calculated expansion of more than 3/4 inch (19 mm).
3. Grout end bells into structure walls from both sides to provide watertight entrances.

I. Building Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Provide sleeves at building penetration and make water-tight with sleeve seal.

J. Duct Support

1. For concrete encased applications, support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Separator Installation: Space separators at a maximum of 5-feet to prevent sagging and deforming of ducts. Place spacers within 24-inches of duct ends. Stagger separators approximately 6 inches between tiers.
3. Minimum Space between Ducts: 3 inches between ducts and between ducts and exterior envelope wall.

K. Concrete-Encased Ducts:

1. Secure separators to earth and to ducts to prevent floating during encasement. Tie entire assembly together using non-ferrous tie-wires or straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Reinforcement: Where indicated, reinforce concrete-encased duct banks for their entire length. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
3. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.

4. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct and exterior envelope wall.
5. Concrete Encasement:
    a. Use normal strength concrete, minimum 3000 psi at 28 days, 6 to 8 inch slump, with maximum 1/2 inch aggregate.
    b. Comply with requirements in "Concrete Placement" Article in Division 03. Place concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope.
    c. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces.
    d. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
6. Complete final backfilling after concrete has cured.

L. Direct-Buried Duct Banks:

1. Set elevation of bottom of duct bank below frost line.
2. After installing first tier of ducts, install initial backfill and compact.
3. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process.
4. Perform initial backfilling/encasement in 2-inch lifts. Compact to 95% standard proctor density.
5. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over ducts and hand tamp.
6. Firmly tamp initial backfill around ducts to provide maximum supporting strength. Use hand tamper only.
7. After placing initial backfill over final tier, make final duct connections at end of run and complete backfilling.
8. Initial backfill/encasement material shall be crushed stone, sand, or pea gravel with a maximum aggregate size of 1/2-inch.

M. Warning Tape: Bury warning tape approximately 12 inches above all ducts. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

N. Install pull tape in all spare ducts with 3ft of slack tied off and secured at each pull point.

O. Duct Sealing:

1. Provide temporary plugs of all ducts upon completion of each portion of work to prevent ingress of foreign material into the duct.
2. After conductors have been installed seal all ducts, including spare ducts, at building entrances and equipment terminations. Use sealing compound and foam plugs capable of withstanding at least 15-psig hydrostatic pressure.

3.5 INSTALLATION OF CONCRETE HANDHOLES, AND BOXES

A. Precast Concrete Handhole Installation:

1. Comply with ASTM C 891 unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances.

3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.

C. Where indicated, cast handhole cover frame integrally with handhole structure.

D. Waterproofing: Apply waterproofing to exterior surfaces of handholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints, and connections, and touch up abrasions and scars.

E. Hardware: Turn over removable hardware, including pulling eyes, cable stanchions, cable arms, to Construction Manager for use during next phase.

F. Field-Installed Bolting Anchors in Concrete Handholes: Do not drill deeper than 2 inches (50 mm) for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install hand-holes and boxes level and plumb and with orientation and depth coordinated with connecting ducts, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a12-inch thick level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade. Install handholes and boxes with bottom below frost line.

D. Field cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

E. For enclosures installed in asphalt paving, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.

1. Concrete: 3000 psi, 28-day strength, complying with Division 03, with a troweled finish.
2. Dimensions: minimum 10 inches wide and 12 inches deep or as shown on drawings.

3.7 GROUNDING

A. Comply with Section 260526 “Grounding and Bonding for Electrical Systems”.

1. Grounding Handholes: Install a driven ground rod through handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. Protect ground rods

passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

3.8 IDENTIFICATION

A. Comply with Section 260553 “Identification for Electrical Systems”

1. Where ducts transition through handholes, and at each termination point, provide each duct with a unique identifier to indicate origination point.
2. Cover legends shall be consistent with the owner’s standard practices, especially within existing facilities, unless otherwise require by codes.

3.9 FIELD QUALITY CONTROL

A. Prior to covering duct or underground structures, perform visual inspections to verify the following:

1. Proper installation depths and slopes have been maintained.
2. Proper vertical and horizontal spacing in multi-duct formations.
3. All conduit sections have been properly jointed.
4. Proper bend radius of curved sections have been maintained.
5. Check for damage at changes in grades or at bends.

B. Perform the following tests and inspections and prepare test reports:

1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for duct deflections or out of round conditions. Provide a minimum 6-inch- long mandrel 1/2-inch smaller in diameter than diameter of duct. If obstructions are discovered, remove obstructions and retest.

C. Correct deficiencies, replace affected duct sections, and retest as specified above to demonstrate compliance.

D. Prepare detailed test and inspection reports with accompanying digital photographs.

E. Concealed Work Photographs: Before proceeding with installing backfill that will conceal work, take photographs sufficient in number, with annotated descriptions, to record nature and location of concealed Work.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of all ducts until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Equipment Nameplates.
2. Cable and Conductor Labels.
3. Wiring Device Labels
4. Safety Labels.
5. Instruction Signs.
6. Miscellaneous identification products.

B. Related Requirements

1. Refer to Section 260573, “Power System Studies” for additional requirements related to fault current and arc flash labeling.
2. Refer to Section 270553, “Identification for Communications Systems” for additional requirements related to labeling of communications equipment and cabling.

1.3 REFERENCES

A. Abbreviations

B. Definitions

1. Emergency Systems: Those systems legally required and classed as emergency by NFPA 70 Article 700, municipal, state, other codes, or by any government agency having jurisdiction.
2. Essential Electrical Systems: Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. American National Standards Institute (ANSI)
    a. ANSI Z535.4, “Product Safety Signs and Labels”
2. National Fire Protection Association (NFPA)
    a. NFPA 70E, “Standard for Electrical Safety in the Workplace”

3. Occupational Safety and Health Administration (OSHA)
    a. 29 CFR 1910.144, “Safety color code for marking physical hazards”
    b. 29 CFR 1910.145, “Specifications for accident prevention signs and tags”
4. Underwriters Laboratories Inc (UL)
    a. UL 969, “Marking and Labeling Systems”

1.4 SUBMITTALS

A. Product Data: For each electrical identification product indicated.
    1. Include project specific examples of each label type.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

C. Closeout Submittal:
    1. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
        a. Provide electronic Excel files of all panelboard directories to owner as part of Close-out Documentation.

1.5 COORDINATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes and standards. Use consistent designations throughout Project.

B. All identifications shall be consistent with the owner’s standard practices, especially within existing facilities, unless otherwise require by codes. Where the requirements herein are in conflict, the contractor shall notify the engineer in writing prior to ordering any material.

C. All room names and/or numbers for labeling or programming shall use the Owner’s approved room name and numbering scheme, not names and numbers indicated on floor plans. All reprogramming shall be included as required to accommodate construction phasing.

D. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

E. Coordinate installation of identifying devices with location of access panels and doors.

F. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT SIGNS AND NAMEPLATES

A. Engraved Plastic Signs and Nameplates.

1. 3-layer melamine plastic laminate
2. Weather and UV-resistant for Wet and Damp Locations.
3. Thickness:
    a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    b. For signs larger than 20 sq. in. or 8 inches in length, 1/8 inch thick.
    c. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
    d. Framed with mitered melamine molding and arranged for attachment at applicable equipment.
4. Color: Comply with color legend.

2.2 RACEWAY AND CONDUCTOR LABELS

A. Raceway Labels: Pre-printed, self-adhesive, polyester, suitable for indoor or outdoor use, resistant to abrasion, humidity, and weather.

1. Color: Black Letters on an orange field.
2. Size: For each raceway size, comply with ANSI/ASME A13.1 for recommended letter height and field length.

B. Wire and Cable Labels: Machine printed, self-adhesive, polyester, self-laminating, suitable for indoor or outdoor use on flexible cables, resistant to abrasion, humidity, and weather.

2.3 SAFETY SIGNS AND LABELS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. All field-applied hazard markings shall warn of hazards using effective words, colors, symbols, or any combination thereof as recommended by ANSI Z535.4-2011. This applies to all instances where caution, warning, or danger signs are required per the NEC and applicable OSHA standards.

C. Self-Adhesive Safety Labels: Polyester, Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for intended use and suitable for installed environment.

D. Provide UV overlaminating film for outdoor locations.

2.4 INSTRUCTION SIGNS

A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.

B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.5 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Floor Marking Tape: 2-inch wide, 5-mil pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

B. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system suitable for surface material and location (exterior or interior).

C. Fasteners for Labels and Signs:

1. Self-tapping, stainless-steel screws, or stainless-steel machine screws with nuts and flat and lock washers.
2. Pop-Rivets.
3. Two-Part Epoxy Adhesive

D. Cable Ties: Self-extinguishing, one-piece, self-locking, UV-stabilized or plenum rated where required by installed environmental conditions. 3/16-inch minimum width.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Verify identity of each item before installing identification products.

B. Before installation of labels, clean all surfaces using materials and methods recommended by manufacturer of identification device.

C. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

E. Install all labels in a neat manner, plumb and parallel to equipment lines.

F. Attach plastic signs and labels to equipment with mechanical fasteners appropriate to the location and substrate. Where screws cannot or should not penetrate substrate use specifically approved two-part epoxy adhesive.

G. Hand written, non-permanent, or stenciled labels are not permitted unless noted otherwise.

H. For surfaces that require finish work, apply identification devices to surfaces after completing finish work.

I. Identification shall consist of all UPPER-CASE LETTERS.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

3.2 EQUIPMENT IDENTIFICATION

A. Provide all new and modified equipment with a nameplate consisting of 1/2" letters for equipment designation and 1/4" letters for voltage, source, and feeder information. This includes but is not limited to panelboards, switchboards, switchgear, disconnect switches, transformers, power transfer equipment, generators, motor starters, variable frequency drives,

lighting control panels, contactors, cabinets, push button stations, and auxiliary system control panels.

B. Distribution equipment labels shall indicate the following:
1. Equipment designation.
2. Voltage system.
3. Equipment ampacity.
4. Source equipment designation and location.
5. Feeder size.

C. Transformer labels shall indicate the following:
1. Equipment designation.
2. Primary voltage system and primary feeder ampacity.
3. Source equipment designation and location.
4. Primary feeder size.
5. Secondary voltage system and load equipment designation

D. Equipment disconnect labels shall indicate the following:
1. Equipment designation.
2. Voltage system and feeder ampacity
3. Source equipment designation and location.

E. Locate equipment nameplates at center of top of trim for branch circuit panels, switchgear, and centered at side for branch circuit switches.

F. Where equipment is provided with a factory installed disconnecting means or motor controller, install label on factory provided unit.

G. For equipment with multiple power sources, such as transfer switches and control panels, identify each source and its function.

H. Color Legend

1. Normal Power Systems: Black field with white letters
2. Emergency Power Systems (As defined by NEC Article 700): Red field with white letters.

I. Where electrical distribution equipment, including panelboards, switchboards, and switchgear, are connected to an emergency source, the nameplate shall incorporate the word "EMERGENCY" into the legend. Refer to drawings for further details.

J. Where the premise wiring system has feeders and/or branch circuits supplied from more than one nominal voltage system, provide sign at each switchgear, switchboard, and panelboard displaying color coded identification method for each ungrounded, grounded, and equipment grounding conductor.

K. Service Equipment and Building Feeder, Branch Circuit Disconnects.

1. Provide label for service disconnecting means to permanently identify it as the “SERVICE DISCONNECT”.
2. Where a building or structure has any combination of feeders, branch circuits, or services passing through it or supplying it, provide a permanent sign at each disconnect location identifying all other feeders, branch circuits, or services and the area served by each.

3.3 IDENTIFICATION OF CONDUCTORS

A. Service, Feeder, and Branch-Circuit Conductors: Refer to Section 260519, “Low Voltage Electrical Power Conductors and Cables” for conductor and cable color coding requirements.

B. Indicate source and circuit number of conductors to be extended in the future.

C. Auxiliary Systems Alarm, Signal, and Control Wire Identification: At termination points, identify each conductor by its system, designation, and function.

3.4 IDENTIFICATION OF RACEWAYS AND BOXES

A. Identify all junction, outlet, device, and pull boxes with wiring system, voltage, and circuit designations of conductors.

1. In concealed locations above accessible ceilings and in exposed unfinished areas such as data, mechanical, or electrical rooms, provide designations on outside of box covers.
2. For exposed boxes in finished areas, provide designations on inside of box covers.
3. System Legend shall be as follows:
    a. Power
    b. Emergency
    c. UPS

B. The inside of all junction and backboxes shall be marked with panel and circuit number in permanent marker.

C. All empty conduit runs and conduit with conductors for future use shall be identified for use and shall indicate where they terminate.

3.5 IDENTIFICATION OF WIRING DEVICES

A. All new and existing receptacle cover plates in area of work shall be marked with their panel and circuit number(s) with clear, machine printed adhesive labels with black lettering.

3.6 PANELBOARD CIRCUIT DIRECTORIES

A. For Distribution Panelboards, Switchboards, and Switchgear, provide nameplates at each switch or circuit breaker to indicate load designation.

B. Provide clearly legible typewritten directories in each electrical panel indicating the area, item of equipment, etc. controlled by each switch, breaker, fuse, etc. These directories are to be inserted into plastic cardholders on back door in each panel. Descriptions shall identify each circuit as to its clear, evident, and specific purpose or use. The identification shall include an approved degree of detail that allows each circuit to be distinguished from all others. Spaces and Spare positions shall be described accordingly.

1. At a minimum, provide the following panel information for each panel directory:
    a. Panel name
    b. Panel bus rating
    c. Voltage System
    d. Mains Configuration and Rating
    e. Short Circuit Current Rating

2. Circuit Designation Examples:
   a. LIGHTS, ROOM 100
   b. FLOOR RECEPTACLES, ROOM 200
   c. ERV-1 RECEPTACLE, ROOF

C. Panel Schedules and circuit numbers on Record Drawings shall match.

D. All existing panels shall also be provided with new updated typewritten directories.

3.7 SAFETY SIGNS

A. Install Warning, Caution, and Danger signs in accordance with NFPA 70 and OSHA requirements to ensure safe operation of electrical equipment and the items to which they connect.

B. Comply with 29 CFR 1910.145 and ANSI Z535.4.

C. Apply to exterior of door, cover, or other access point.

D. Labels and signs shall include, but are not limited to, the following legends:

1. Identify system voltage with black letters on an orange background.
2. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
3. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES”
4. Where series combination ratings are allowed: “CAUTION - SERIES COMBINATION SYSTEM RATED ____ AMPERES. IDENTIFIED REPLACEMENT COMPONENTS REQUIRED.”

3.8 INSTRUCTION SIGNS

A. Operating Instruction Signs: Install instruction signs with minimum 3/8-inch letters to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation, power transfer, and load shedding.

3.9 WORKSPACE INDICATION

A. Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

END OF IDENTIFICATION FOR ELETRICAL SYSTEMS

SECTION 26 05 73 - POWER SYSTEM STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Section includes the following computer-based studies:

1. Fault-current study to determine the minimum interrupting capacity of circuit protective devices.
2. Overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.
3. Arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

B. Related Requirements

1. Refer to Section 260553, “Identification for Electrical Systems” for label material and performance requirements.

1.3 REFERENCES

A. Abbreviations
1. SCCR: Short-circuit current rating.

B. Definitions

1. Emergency Electrical Systems: Those systems legally required and classed as emergency by NFPA 70 Article 700, municipal, state, other codes, or by any government agency having jurisdiction.
2. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
3. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
4. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
5. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
6. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
7. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
8. Single-Line Diagram: See "One-Line Diagram."

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. Institute of Electrical and Electronics Engineers (IEEE)

a. IEEE 141 - Recommended Practice for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
b. IEEE 241 - Recommended Practice for Electric Power Systems in Commercial Buildings
c. IEEE 242 - Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
d. IEEE 399 - Recommended Practice for Industrial and Commercial Power System Analysis
e. IEEE 551 - Recommended Practice for Calculating AC Short-Circuit Currents in Industrial and Commercial Power Systems
f. IEEE 1015 - Recommended Practice for Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
g. IEEE 1584 - Guide for Performing Arc-Flash Hazard Calculations
h. IEEE 3002.3 - IEEE Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems

2. American National Standards Institute (ANSI)

a. ANSI C57.12.00 - Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
b. ANSI C37.13 - Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
c. ANSI C37.010 - Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
d. ANSI C 37.41 - Standard Design Tests for High Voltage Fuses, Distribution Enclosed Single-Pole Air Switches, Fuse Disconnecting Switches and Accessories

3. The National Fire Protection Association (NFPA)

a. NFPA 70E - Standard for Electrical Safety in the Workplace

1.4 SEQUENCING

A. The short-circuit and protective device coordination studies shall be submitted for review prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for manufacturing.

B. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Initial Study Report: The study shall provide sufficient data to ensure that selection of equipment and devices will have adequate ratings and the protective device trip characteristics will be satisfactory. Include the following:

1. Study input data, including completed computer program input data sheets including assumptions on worst case project conditions.
2. Study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.

C. Final Study and Report: Submit final study at the end of the construction when all circuits are installed, and all equipment is on site and installed such that complete and accurate data can be obtained.

D. Closeout Submittals

1. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:

a. Provide five (5) bound copies of the complete final report. Additional copies shall be provided on CD or USB in PDF format.
b. Certification Document to confirm system settings have been implemented.
c. At the owner's option, provide the study project files in electronic format including all project files and libraries to allow the owner to update and print additional copies, labels, etc.

1.6 QUALITY ASSURANCE

A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.

B. Software algorithms shall comply with requirements of standards and guides specified in this Section.

C. Manual calculations are not acceptable.

D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located and skilled in performing and interpreting the power system studies. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

1. Engineer shall be a full-time employee of the electrical equipment manufacturer.
2. The engineer shall have a minimum of five (5) years' experience performing power system studies.

E. Power System Study Certification: Report shall be signed and sealed by Power Systems Analysis Specialist.

F. Field Adjusting Personnel Qualifications:

1. Technician shall be a full-time employee of the electrical equipment manufacturer.
2. Technician responsible for all field adjusting of the Work shall have a minimum NICET Electrical Power Testing Level III certification or equivalent.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

A. Perform studies using the latest version of Power Tools for Windows by SKM Systems Analysts.

B. Comply with IEEE 242, IEEE 399, IEEE 551, IEEE 1584, IEEE 3002.3, and NFPA 70E.

C. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

2.2 POWER SYSTEM STUDY REPORT CONTENTS

A. Executive summary of study findings.

B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

C. One-line diagram of modeled power system, showing the following:

1. Protective device designations and ampere ratings.
2. Conductor types, sizes, and lengths.
3. Transformer kilovolt ampere (kVA) and voltage ratings.
4. Motor and generator designations and kVA ratings.
5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
6. Derating factors and environmental conditions.
7. Any revisions to electrical equipment required by the study.

D. Study Input Data

1. Available Power source data.
2. Manufacturer, model, and interrupting rating of protective devices.
3. Conductors.
4. Transformer data.

E. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.

F. Protective Device Evaluation:

1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment SCCR ratings exceed available short-circuit current at equipment installation locations.
2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that SCCR ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

G. Short-Circuit Study Output Reports:

1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Equivalent impedance.

2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. Calculated asymmetrical fault currents:

      1) Based on fault-point X/R ratio.
      2) Based on calculated symmetrical value multiplied by 1.6.
      3) Based on calculated symmetrical value multiplied by 2.7.

3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:

   a. Voltage.
   b. Calculated symmetrical fault-current magnitude and angle.
   c. Fault-point X/R ratio.
   d. No AC Decrement (NACD) ratio.
   e. Equivalent impedance.
   f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
   g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

H. Protective Device Coordination Study:

1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.

   a. Phase and Ground Relays:

      1) Device tag.
      2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
      3) Recommendations on improved relaying systems, if applicable.

   b. Circuit Breakers:

      1) Adjustable pickups and time delays (long time, short time, and ground).
      2) Adjustable time-current characteristic.

3) Adjustable instantaneous pickup.
4) Recommendations on improved trip systems, if applicable.

2. Fuses: Show current rating, voltage, and class.

I. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:

a. Power utility's overcurrent protective device.
b. Medium-voltage equipment overcurrent relays.
c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
f. Cables and conductors damage curves.
g. Ground-fault protective devices.
h. Motor-starting characteristics and motor damage points.
i. Generator short-circuit decrement curve and generator damage point.
j. The largest feeder circuit breaker in each motor-control center and panelboard.

5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

J. Arc-Flash Study Output Reports:

1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:

a. Voltage.
b. Calculated symmetrical fault-current magnitude and angle.
c. Fault-point X/R ratio.
d. No AC Decrement (NACD) ratio.
e. Equivalent impedance.
f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

K. Incident Energy and Flash Protection Boundary Calculations:

1. Arcing fault magnitude.
2. Protective device clearing time.

3. Duration of arc.
4. Arc-flash boundary.
5. Restricted approach boundary.
6. Limited approach boundary.
7. Working distance.
8. Incident energy.
9. Hazard risk category.
10. Recommendations for arc-flash energy reduction.

2.3 ARC-FLASH WARNING AND AVAILABLE FAULT CURRENT LABELS

A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each location indicated in the analysis unless noted otherwise.

B. Arc Flash Warning Labels shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include all information required by NFPA 70E and the following information taken directly from the arc-flash hazard analysis:

1. Location designation.
2. Engineering report number, revision number, and issue date.

C. Available Fault Current Labels shall have an orange header with the wording, “WARNING”, and shall include the following information taken directly from the short circuit study.

1. Location designation.
2. Maximum available fault current.
3. Calculation date.
4. Engineering report number, revision number, and issue date.

D. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

A. Obtain all data necessary for conduct of the study.

1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Engineer's attention.
2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
3. For relocated equipment and that which is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.

B. Electrical Survey Data: Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required

to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study. Data includes, but is not limited to, the following:

1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Electrical power utility impedance and available short circuit current at the service.
3. Power sources and ties.
4. Short-circuit current at each system bus (three phase and line to ground).
5. Full-load current of all loads.
6. Voltage level at each bus.
7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Derating factors.
16. Data sheets to supplement electrical distribution system one-line diagram, cross-referenced with tag numbers on diagram, showing the following:
    a. Special load considerations, including starting inrush currents and frequent starting and stopping.
    b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
    c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
    d. Generator thermal-damage curve.
    e. Ratings, types, and settings of utility company's overcurrent protective devices.
    f. Special overcurrent protective device settings or types stipulated by utility company.
    g. Time-current-characteristic curves of devices indicated to be coordinated.
    h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
    i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
    j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
    k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.2 POWER SYSTEMS STUDY

A. Perform study following the general study procedures contained in IEEE 399.

B. Base study on device characteristics supplied by device manufacturer.

C. Gather all necessary data from the existing facility as needed to perform the study.

D. The Contractor shall be responsible for modifying settings on existing equipment only at over-current protection devices upstream of new equipment unless noted otherwise.

E. The scope of the studies shall include all new distribution equipment and devices indicated on Drawings as well as all directly affected existing distribution equipment and devices at the customer facility. Begin analysis at the distribution system utility service, extending down to system overcurrent protective devices.

F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.

G. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.

H. Identify in the report any protective device applied outside its capacity.

I. Short Circuit Study

1. Calculate short-circuit currents according to IEEE 551.
2. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
    a. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
3. Evaluate equipment and protective devices and compare to short-circuit ratings.

J. Coordination Study

1. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
2. Transformer Primary Overcurrent Protective Devices:
    a. Device shall not operate in response to the following:
        1) Inrush current when first energized.
        2) Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
        3) Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
    b. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
3. Motor Protection:
    a. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
    b. Select protection for motors served at voltages more than 600 V according to IEEE 620.

4. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
5. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.

K. Arc Flash Hazard Analysis

1. Comply with NFPA 70E and its Annex D for hazard analysis study.
2. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.
3. Calculate maximum and minimum contributions of fault-current size.
   a. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
   b. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
4. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
5. Include medium- and low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.
6. Calculate the limited, and restricted approach boundaries for each location.
7. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
   a. Fault contribution from induction motors shall not be considered beyond three to five cycles.
   b. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
8. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
   a. When the circuit breaker is in a separate enclosure.
   b. When the line terminals of the circuit breaker are separate from the work location.
9. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 LABELING

A. All labels will be based on recommended overcurrent device settings and will be provided to owner after the results of the analysis have been presented and after any system changes, upgrades, or modifications have been incorporated in the system.

B. Arc Flash Labeling:

1. Provide and install an arc-flash label for each piece of electrical equipment listed below and each piece of equipment that is likely to require examination, adjustment, servicing, or maintenance while energized:

a. Motor-control centers.
b. Switchboards.
c. Switchgears.
d. Meter Enclosures.
e. Medium voltage and low volage transformers
f. Panelboards.
g. Equipment Control panels.
h. Motor Controllers.
i. Disconnect Switches.

2. Apply arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.

C. Available Fault Current Labeling

1. Provide and install an available fault current label for each piece of electrical equipment listed below:

a. Service equipment.
b. Elevator Control Panel.

D. Install warning labels under the direction of the Power System Analysis Specialist.

E. Provide new labels for any existing equipment to remain with updated values based on the results of the analysis.

3.4 FIELD ADJUSTING

A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by a qualified technician from the engineering service division of the equipment manufacturer.

B. Make modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.

C. Notify Architect and Engineer in writing of any required major modifications.

D. Equipment shall not be energized until all breakers or protective relays are set either to the recommended values indicated by the studies or to minimum trip settings.

E. Certification: Prior to project Substantial Completion, submit four signed copies of a document certifying that the settings and selection scope has been completed as specified.

3.5 DEMONSTRATION

A. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.

B. Hand-out and explain the power system study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.

C. Arc Flash Training

1. Train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels (minimum of 4 hours).
2. The training shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET) or equivalent.
3. Include in Project Close-out Documents training notes, outlines, and Power Point presentation of training session. Also include attendance record of personnel attending the training session.
4. Training session shall be videotaped. Include copy of DVD of training session in Project Close-out Documents.

END OF POWER SYSTEM STUDIES

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: The purpose of the commissioning process is to provide the owner/operator of the facility with a high level of assurance that the electrical systems have been installed in the prescribed manner and operate within the performance guidelines set in the Basis of Design Documents (BoD). The CxA shall provide the owner with an unbiased, objective view of the system’s installation, operation, and performance. This process is not intended to take away or reduce the responsibility of the design team or installing contractors to provide a finished product. Commissioning is intended to enhance the quality of system start-up and aid in the orderly transfer of systems for beneficial use by the owner. The CxA will be a member of the construction team, administrating and coordinating commissioning activities with the design team, construction manager, subcontractors, manufacturers, and equipment suppliers.

B. The independent commissioning agent (CxA) is contracted directly with the owner for this project. This specification has been included for reference only to define contractors’ responsibilities. Each contractor should review this procedure and include adequate time in their proposal.

C. Section Includes commissioning process requirements for the following Electrical systems, assemblies, and equipment.

1. Power Distribution Equipment
2. Emergency Power Systems
3. Lighting Control Systems
4. Energy Metering System
5. BAS system interfaces

D. Related Requirements:

1. Refer to Division 01 Section “General Commissioning Requirements” for general commissioning process requirements.

1.3 REFERENCES

A. Abbreviations and Acronyms

1. CxA: Commissioning Authority.
2. TAB: Test and Balance

B. Definitions

1. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.
2. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

C. Reference Standards

1. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
   a. ASHRAE Guideline 1-1996, “The HVAC Commissioning Process”
   b. ASHRAE Guideline 0-2005, “The Commissioning Process”
2. AABC Commissioning Group (ACG)
   a. ACG Commissioning Guideline – 2005

1.4 COORDINATION

A. Contractors Responsibilities:

1. Assure acceptable representation, with the means and authority to prepare and coordinate execution of the electrical commissioning program as described in the contract documents.
2. Provide the CxA with copies of all construction documents, addenda, change orders and appropriate approved submittals and shop drawings for review and use in development of the commissioning plan.
3. Coordinate inclusion of commissioning activities in the construction schedule.
4. Facilitate resolution of deficiencies identified by observation or performance testing.
5. Attend commissioning meetings scheduled by the CxA.
6. Verify proper installation and performance of all Electrical systems provided.
7. Complete System Verification Checklists and manufacturer’s pre-start checklists prior to scheduling startup of equipment.
8. Monitor and respond to Resolution Tracking Forms distributed by the CxA in order to expedite corrective actions necessary to achieve design intent.
9. Provide an Electrical system technician to assist during verification and performance testing.
10. Participate in the Functional Performance Tests as required to achieve design intent.
11. Participate in the off-season mode testing as required to achieve design intent.
12. Participate in O&M Training as required by project specifications.
13. Provide provisions to power any and all test equipment required to complete commissioning process such as blower door fans.

B. CxA’s Responsibilities:

1. Inform the Contractor, Owner, and design team on the status, integration, and performance of Electrical systems within the facility.
2. Disseminate information and assist the design and construction teams in implementing completion of the construction process. This shall include system verification, functional performance testing, and conformance with the intended design of each system. Services include documenting construction observations, verification, and functional performance testing, and documenting proper distribution of performance and operating information to the owner’s O&M staff.
3. Assist the responsible parties to maintain a high-quality level of installation by meeting or exceeding prevailing standards and specifications.

4. Observe and coordinate testing as required to assure system performance meets the design intent.
5. Document the results of the performance testing directly and/or assure that the appropriate technicians document testing. The CxA shall approve standard forms to be used by all parties for consistency of approach and type of information to be recorded.
6. Provide technical expertise to oversee and verify the correction of deficiencies found during the commissioning process.
7. Remain an independent party with specific knowledge of the project. The CxA shall investigate the scope and extent of the problem and facilitate communication to determine responsibilities by delineating specifications. The CxA shall monitor resolution for conformance with design intent and prevailing industry standards.
8. Document the date of acceptance as determined by the Contractor, Owner, and Design Team. System Verification Checklists and Functional Performance Test results may be used in determining the start of the warranty period for Electrical systems and subsystems.
9. Review operating and maintenance materials for Electrical systems.
10. Review phasing plans as provided by the Contractor relating to temporary use of Electrical equipment, O&M considerations, warranty issues, impact of construction sequencing on occupied areas, and interruption of services from the existing equipment.

PART 2 - PRODUCTS

A. NOT USED

PART 3 - EXECUTION

3.1 TESTING PREPARATION

A. Certify that Electrical systems, subsystems, and equipment have been installed, calibrated, and started and are operating according to the Contract Documents.

B. Certify that Lighting control systems have been completed and calibrated, that they are operating according to the Contract Documents, and that pretest set points have been recorded.

C. Certify that testing, adjusting, procedures have been completed and that testing, adjusting, and reports have been submitted, discrepancies corrected, and corrective work approved.

D. Set systems, subsystems, and equipment into operating mode to be tested (e.g., normal shutdown, normal auto position, normal manual position, unoccupied cycle, emergency power, and alarm conditions).

E. Inspect and verify the position of each device and interlock identified on checklists.

F. Check safety cutouts, alarms, and interlocks with smoke control and life-safety systems during each mode of operation.

G. Testing Instrumentation: Install measuring instruments and logging devices to record test data as directed by the CxA.

3.2 GENERAL TESTING REQUIREMENTS

A. Provide technicians, instrumentation, and tools to perform commissioning test at the direction of the CxA.

B. Scope of Electrical testing shall include the entire lighting control installation and emergency power system. Testing shall include measuring capacities and effectiveness of operational and control functions.

C. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.

D. The CxA along with the Contractor, shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.

E. Tests will be performed using design conditions whenever possible.

F. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions (such as load banking generator). Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxA and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.

G. The CxA may direct that set points be altered when simulating conditions is not practical.

H. If tests cannot be completed because of a deficiency outside the scope of the electrical system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.

I. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.3 COMMISSIONING PLAN

A. Commissioning Team

1. The Commissioning Team (CT) shall consist of key parties involved in design, construction, and testing of this facility. It is necessary for each party to appoint team members that will have long-term commitments to this project. Switching team members during the project will reduce the ability of the CT to provide continuity and acceptable results to the building owner. Team members must maintain an ongoing supervisory position on this project. One team member shall be provided by each party.

B. Basis of Design Document

1. The Basis of Design Document (BoD) represents a composite of design drawings, project specifications, submittals, change orders and industry standards that describe the systems of this facility. References to design intent will be taken from these contract documents. The BoD is an evolving manuscript maintained by the design professional to track and incorporate design alterations that occur throughout the construction process. Any industry standards used for this project will be specifically noted when referenced.

2. The CxA will review the BoD documents for adequate commissioning provisions, functional performance, optimization of performance, accessibility, TAB provisions, and O&M considerations.

C. Commissioning Meetings

1. Commissioning meetings will be held in conjunction with progress meetings as necessary. The CxA will be on site for the Cx meetings. Commissioning meetings will be used to address any problems that alter the design intent or affect the commissioning process. These meetings provide an open forum for exchange of ideas between contractors, vendors, designers, users, and owners.

D. Resolution Tracking Forms (RTF)

1. The use of Resolution Tracking Forms is a method employed by the CxA to monitor and record problems, their causes, and solutions. The use of these lists promotes communication between the installing contractors, design team, commissioning agent, and owner, in order to expedite their resolution in a timely manner.
2. The CxA will regularly submit RTF's to the CT in order to document and resolve deficiencies as quickly as possible. The frequency of RTF submission will be adjusted as project conditions dictate.

E. System Verification Checklists (SVC) / Manufacturers' Checklists

1. The CxA will write SVC's based on the BoD. These tests will be created for systems and subsystems included in the commissioning process. Draft copies will be submitted to the team for review and comment prior to placement on the job site. A master copy of the SVC's will be bound in a three-ring binder and placed on the job site for use by the installing contractors. No system will be started until the appropriate SVC's have been completed.
2. The CxA will review the SVC for each piece of equipment prior to start-up. Equipment will be released for start-up only after these checklists have been completed by the installing contractor and reviewed by the CxA.
3. The equipment manufacturers' checklists must also be reviewed by the CxA prior to start-up. These lists must be completed by the installing contractor and reviewed by the CxA before start-up can commence.

F. Start-Up

1. Start-up of major Electrical systems will be witnessed the CxA. The appropriate contractors and/or manufacturer's representative will be required on site to perform start-up. No system will be started until the appropriate SVC's have been completed. No system will be started until the Manufacturer's checklists have been completed. Start-up will be performed according to the Manufacturer's recommended procedures. The CxA will visit the site to review completeness of installation in conjunction with progress meetings prior to starting Electrical equipment.
2. Team members involved in installation, fabrication, manufacture, control, or design of equipment are required to be present at the time of start-up. A factory-authorized technician will be on site to start equipment where required by the specifications. This will minimize delays in bringing equipment on line and expedite acceptable functional performance in accordance with the BoD.

G. Energy Metering System quality control

1. Contractor shall verify good installation practice and ways and means have been met:
   a. Neat and professional installation
   b. All boxes have covers installed with all mounting hardware

c. Current Transformers are installed in the same orientation with the flow of current from the source (Installation dot, wire exit from device, mold mark arranged in the same direction)
d. All conductors are insulated up to the point of termination into equipment.
e. All signal ground conductor jackets are terminated at the equipment control panel.
f. Contractor shall gather CT readings using clamp on ammeter, simultaneous readings from associated metering channel shall be taken to assure accurate measurement. All readings shall be indicated in a system startup document.
g. CxA to witness metering verification.

H. Controls Monitoring

1. Close monitoring of the Control Contractor's progress will promote efficient coordination of the Electrical work. The Controls Contractor will be expected to submit point-to-point checklists verifying that their work has been completed and all systems are ready for Electrical work and Functional Performance Testing. Programming and graphics will be surveyed by the CxA for completeness and conformance with the BoD and the owner's scheduling requirements.

I. TAB Monitoring

1. The preliminary TAB report set-up will be reviewed prior to Electrical equipment start-up, in order to assure that the final TAB report format and content is acceptable.
2. TAB work will be monitored so that any problems that prevent or hinder proper air and water balance can be addressed and corrected with minimal delays. By addressing these problems as quickly as possible, we can assure that functional performance testing and owner training will take place on schedule.
3. A pencil copy of the TAB report will be reviewed prior to submission of the final TAB report. A written review will be submitted to the TAB contractor and to the DT for their comments. A TAB report approved by the DT will be required before Functional Performance Testing can be carried out. The CxA will visit the site during the TAB process in order to assist TABC and CC in the effective completion of their scope of work.

J. Functional Performance Tests (FPT)

1. The CA will write FPT's based on the BoD. These tests will be created for systems and subsystems included in the commissioning process.
2. Each major system will be tested. A random sample of each subsystem will be tested. This will be coordinated and witnessed by the CxA and the owner's representative. Witnessing the FPT's will serve as a compliment to the O&M Training. No FPT's will be performed until the system and related subsystems have been started, and the completion of the control system has been documented through point-to-point checklists and other documentation.
3. The Functional Performance Tests shall include Electrical Distribution, Lighting Controls, Emergency Power, and related equipment as well as any interfaces to the Building Automation System.

a. The Electrical trade representative will demonstrate to the CxA: main power disconnect switch and feeder disconnect switches overcurrent ground fault sensor trip settings by the primary injection method and in accordance with NETA-ATS Section 7.6, switchboard assemblies megger tested in accordance with NETA-ATS Section 7, switchboard metering instrumentation tests in accordance with NETA-ATS Sections 7.10 and 7.11, and switchboard single phase monitor tests for operation upon loss of a phase.
b. The electrical trade representative will demonstrate to the CxA: Initial installation and prestart checks of generator as required by CxA. Start engine and generator under varying loads and test temperature, pressure, noises, vibrations, voltage,

frequency, etc. Provide technicians, instrumentation, tools, and equipment to test performance of generator(s), transfer switches, annunciators, and other associated components of the emergency stand-by power system.

c. Lighting controls will be tested under relevant operating conditions. The electrical trade representative will demonstrate to the CxA: luminaire/lamp combinations by inspection, operational tests for lighting control/dimming systems, illumination level measurements in up to 20% of the building area, and interior lighting control performance, including operation of occupancy sensors, automatic time controls, energy management control override timers, manual dimming control, multi-level switching, and other specified lighting controls.

d. A remote connection to energy metering system, or any other system should be provided to the CxA prior to system start-up for use as a tool to determine completion and accuracy of systems. CxA in conjunction with the CT will ensure that all systems function properly through FPT's and through trend verification of systems.

4. Deferred Testing

a. If tests cannot be completed because of a deficiency outside the scope of the responsible contractor, the deficiencies shall be documented and reported to the Owner. Deficiencies shall be resolved and corrected by the appropriate parties and test rescheduled.

b. Off-season or Unoccupied mode testing will be implemented as necessary to assure conformance with the BoD. Installing contractors will be expected to participate as required by the project specifications.

5. Rescheduled Functional Performance Test

a. During Functional Performance Testing period, it is assumed that the contractors will be complete with all checklists when the commissioning agents travel to site. If the work is not ready for commissioning when the commissioning personnel are on site, their time will be billed to the contractor as an additional fee.

b. If the contractor has deficiencies that cannot be corrected at the time of the test, that part of the sequence will be retested at a later date. If the deficiency does not pass during the retest, the contractor will be billed for the commissioning personnel's return trip.

6. Building Turn-Over / Owner Orientation / User Training

a. The CxA will assist contractors prepare, coordinate and review O&M manuals, working closely with each contractor to achieve specificity and completeness.

b. The CxA will review as-built drawings, working closely with each contractor to achieve specificity and completeness.

c. Owner training will be coordinated with the assistance of the CxA. The training will be provided by the installing contractor, or manufacturer's representative, and witnessed by the CxA. This training should include both classroom training and hands-on operational training. The owner may choose to videotape this training for future use. The CxA will visit the site during the Turn-Over and Training period to assure that any on-going Electrical related problems are being addressed and corrected in a timely and efficient manner.

d. The CxA will assist the owner/user with warranty issues.

e. The CxA will assist in the coordination of off-season testing, calibrating, and servicing as specified in the contract documents.

END OF COMMISSIONING OF ELECTRICAL SYSTEMS

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description:

1. Section includes requirements for the provision of Lighting Controls including manufacturing, fabrication, configuration, and installation as required for the complete performance of the Work, as shown on the Drawings, as specified herein.
2. This work consists of providing all labor, materials, accessories, mounting hardware and equipment necessary for an operationally and aesthetically complete installation of all lighting controls.
3. Specifications and drawings are intended to convey all salient features, functions, and characteristics of the lighting control devices only, and do not undertake to illustrate or set forth every item or detail necessary for the work. Minor details, not usually indicated on the drawings nor specified, but that are necessary for proper execution and completion of the lighting controls shall be included, the same as if they were herein specified or indicated on the drawings.

B. Section Includes:

1. General lighting control devices
2. Digital lighting control devices
3. Lighting Control Relay panels
4. Lighting Control Panelboards
5. Lighting Contactor Cabinets
6. Electronic Digital Time Switches
7. Outdoor Photoelectric Switches
8. Emergency lighting control devices

C. Related Requirements:

1. Refer to Section 260500, “Common Work Results for Electrical Systems” for requirements related to equipment supports.
2. Refer to Section 262726, “Wiring Devices” for requirements related to lighting snap switches and wall plates.

1.3 REFERENCES

A. Abbreviations and Acronyms

1. BAS: Building Automation System.
2. DDC: Direct Digital Controller/Direct Digital Control.
3. IP: Internet protocol.
4. NRTL: Nationally Recognized Testing Laboratory

5. SPD: Surge Protection Device

B. Definitions

1. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in IEEE 100 and ANSI/IES LS-1.
2. Scene: The lighting effect created by adjusting several zones of lighting to the desired intensity.
3. Zone: A light fixture or group of light fixtures controlled simultaneously as a single dimmer/relay/entity.
4. Occupancy Sensor: Motion sensing device programmed as automatic on and automatic off.
5. Vacancy Sensor: Motion sensing device programmed as manual on and automatic off.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA):
   a. NECA NEIS 130, “Standard for Installing and Maintaining Wiring Devices”
2. Underwriters Laboratories, Inc. (UL):
   a. UL 508, “Standard for Industrial Control Equipment.”
   b. UL 773, “Plug-in, Locking Photocontrols for Use with Area Lighting.”
   c. UL 773A, “Nonindustrial Photoelectric Switches for Lighting Control.”
   d. UL 916, “Standard for Energy Management Equipment Systems.”
   e. UL 917, “Clock Operated Switches.”
   f. UL 924, “Emergency Lighting and Power Equipment.”
   g. UL 1008, “Transfer Switch Equipment.”
   h. UL 1449, “Transient Voltage Surge Suppressors.”
   i. UL 2108, “Low-Voltage Lighting Systems.”

1.4 SUBMITTALS

A. Product Data: For each type of product indicated including physical data and electrical performance. Include data on features, accessories, finishes, and the following:

1. Physical description, including dimensions.
2. All available finishes and colors for each device and wall/cover plate shall be submitted to the Architect for selection during review.
3. Control type: 0-10V, DMX, bi-level, etc.
4. Sample Warranty.

B. Shop Drawings: Show installation details for occupancy, vacancy, light-level sensors, and digital control devices.

1. Lighting floor plan showing location, orientation, and coverage area of each wall and ceiling mounted sensor.
2. Interconnection diagrams showing field-installed wiring.
3. Riser diagrams indicating device network and cabling types.
4. Include systems descriptions, set points, and controls settings and adjustment.

C. Manufacturer's Installation Instructions: Include for manufactured components.

D. Control Schedules: After confirming with owner, list operating hours for each day of the week, include observed holidays.

E. Qualification Data: For Start-Up Field Technician

F. Closeout Submittals

1. Operation and Maintenance Data: For each type of product to include in operation and maintenance manuals. In addition to items specified in Division 01 and Section 260010 “General Requirements for Electrical Systems”, include the following:

    a. Description of operation and servicing procedures.
    b. Technical support contact
    c. List of components.
    d. Recommended spare parts.
    e. Programming instructions and system operation procedures.
    f. Include interconnection wiring diagrams complete field installed system with identified and numbered, system components and devices.
    g. Include operation and maintenance manuals for equipment and devices, including sensors, power supplies, and other equipment furnished.
    h. Provide detailed set-up information for furnished equipment, indicating required initial configuration switch settings, jumper positions, to facilitate equipment replacement.
    i. Include device calibration settings after system programming and start-up with manufacturer's representative.

2. Software and Firmware Operational Documentation:

    a. Software operating and upgrade manuals.
    b. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
    c. Device address list.
    d. Printout of software application and graphic screens.

1.5 MAINTENANCE MATERIAL

A. Extra Stock Material: Provide one (1) of each type of sensor, switch, dimmer, power pack, and emergency lighting control device installed. Package with protective covering for storage and identified with labels describing contents.

B. Keys and Special Tools: Provide one extra set for access to locked or tamperproof enclosures.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Manufacturer must maintain an authorized service organization within 100 miles of the project location that stocks a full complement of parts for all equipment specified in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.
2. Provide toll free technical telephone support.

B. Installer Qualifications:

1. An employer of workers qualified and trained in electrical safety as required by NFPA 70E.

C. Start-Up Field Technician Qualifications:

1. Minimum experience of 2 years training in the electrical/electronic field.
2. Certified by the manufacturer on the system installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer instructions for storage of equipment and devices to prevent damage from dirt, moisture, or other environmental concerns.

1.8 COORDINATION

A. Preinstallation Conference: Arrange a pre-installation conference between all applicable subcontractors and architect/engineer prior to the installation of rough-ins for the lighting controls.

B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, speakers, fire alarm, HVAC equipment, fire-suppression system, and partition assemblies.

C. Coordinate protocol and interface points of lighting control devices with temperature controls (BAS/DDC) specified in Division 23.

D. Product procurement and coordination:

1. Order products according to application.
2. Confirm the proper and complete catalog number with distributor and agent.
3. Provide additional parts and pieces required to complete the installation in the location and manner intended by the design.
4. Confirm voltages.

E. Contractor shall coordinate with Vendors and other trades, in advance of installation work, to define all infrastructure and installation requirements. Contractor shall coordinate all infrastructure requirements with all approved lighting control devices prior to infrastructure installation. This includes, but not limited to, appropriately sized, positioned, and located junction boxes, structural supports, feeds, power conduits, control conduits, and remote code-compliant power-supply enclosures.

1.9 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace lighting controls, finishes, wiring, cabling, and all of its components that fail in materials or workmanship within 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70, as well as applicable ANSI, IEC standards, and FCC regulations.

C. Comply with CFR Title 47, Part 15, Subparts A and B, for Class A digital devices.

D. Devices shall be in accordance with NFPA 70, NEMA, and UL listed and labeled.

E. RoHS compliant.

F. Devices located in above ceilings shall be plenum rated.

G. Power failure: Incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and parameters saved in protected memory shall not be lost and should restore system to its last operating state without requiring user input.

H. Failsafe operation: If automatic switching device loses power, device will latch to closed “ON” position.

I. Components shall be designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

J. Products tested in identical manner, complaint to NEMA WD 7 -2011 Occupancy Motion Sensors Standards.

K. Voltage: 120/277VAC unless noted otherwise

L. Line-Voltage Surge Protection: Include in all 120- and 277-V solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

M. Refer to Section 262726 “Wiring Devices” for device and faceplate colors.

N. Standard Operating Range: 32 to 120 deg F, up to 90 percent relative humidity, non-condensing, unless noted otherwise.

O. Minimum load rating: 800W at 120VAC and 1200W at 277VAC.

P. Provide all control devices with LED status indicator.

Q. Minimum Occupancy and Vacancy Sensor Coverage Radius:

1. Wall Switch: 35 ft for large motion, 20 ft for small motion.
2. Ceiling, 360 deg, Standard Range: 12 ft radius for small motion.
3. Ceiling, 360 deg, Extended Range: 28 ft radius for large motion.
4. Corner, 120 deg: 40 ft for large motion.
5. Hallway: 100 ft for large motion.
6. High Bay, 360 deg: 20 ft radius at 15 ft mounting height for large motion

2.2 GENERAL LIGHTING CONTROL DEVICES

A. Basis of Design: Subject to compliance with requirements, provide products indicated on Drawings or equivalent by one of the following:

1. Acuity Sensorswitch
2. Hubbell
3. Leviton
4. Lutron
5. Wattstopper

B. General Requirements:

C. Wall Switch Occupancy and Vacancy Sensors: Decora style sensor with on/off switch(es) for mounting in a single gang switchbox.

1. Programmable Automatic On and Manual On Operating Modes.
2. Time Delay for Automatic Off: Adjustable up to 20 minutes.
3. Programmable sensitivity settings.
4. Sensing Technology: Dual technology, PIR and Ultrasonic or Microphonics unless noted otherwise.

5. Noise filtering to eliminate false triggers.
6. Vandal resistant lens
7. Multi-Way: Multi-way: Capable of operation in 3-way application where indicated.
8. Dimming: Provide 0-10V dimming output where indicated.
9. Dual Relay: Where independent control of two loads is required, provide unit with two isolated relays and override switches, capable of independent operating modes and time delays.

D. Line Voltage Occupancy Sensors: Self-contained occupancy sensor with integral power supply and relay suitable for mounting to a standard outlet box in ceiling and wall mounted applications

1. Automatic On operation.
2. Time delay for Automatic Off: Adjustable up to 20 minutes.
3. Sensing Technology: Dual technology, PIR and Ultrasonic or Microphonics unless noted otherwise.
4. Dual Relay: Where independent control of two loads is required, provide unit with two isolated relays and override switches, capable of independent operating modes and time delays.

E. Low Voltage Occupancy, Vacancy Sensors, Daylight Sensors, Power Packs, and Low Voltage Wall Stations

1. Programmable Automatic On and Manual On Operating Modes.
2. Time Delay for Automatic Off: Adjustable up to 20 minutes.
3. Sensing Technology: Dual technology, PIR and Ultrasonic unless noted otherwise.
4. Noise filtering to eliminate false triggers.
5. Isolated Relay: Low voltage relay with N.O. and N.C. outputs to indicate occupancy status for HVAC interface with BAS/DDC system.
6. Power Packs/Load Controllers: Self-contained power supply with relay module capable of switching 20-amp load.
    a. Class 2, 24VDC output for powering low voltage sensors.
    b. UL 2043 Plenum Rated.
    c. Threaded 1/2-inch nipple, suitable for mounting inside or outside a junction box.
7. Wall stations: Low voltage, decorator style, with single or multiple pushbuttons for interface with power packs and sensors.
    a. Multi-way: Capable of operation in 3-way application.
    b. Manual Dimming: Provide 0-10V dimming output where indicated.
8. Low Voltage Indoor Daylight Sensors: Low voltage, ceiling mounted photosensor that detects changes in light levels.
    a. Suitable for interface with an occupancy/vacancy sensor, power pack, or another field device.
    b. Closed loop device: measures both daylight contribution and controlled electric light contribution.
    c. Open Loop device: measures only daylight contribution.
    d. Desired task level illuminance: Auto calibrating, programmable, with daytime and nighttime on/off setpoints and a dead band to prevent light from cycling.
    e. Auto Dimming: Provide 0-10V dimming output for automatic dimming control of luminaires.

F. Interval Timer Light Switch: Combination countdown timer and conventional switch lighting control unit, switchbox mounted, decorator style.

1. On/Off Switch with Status LED.
2. Adjustable preset intervals.

3. Warning: Audible and/or flash timeout warning.

G. Wallbox Dimmer Switches

1. Single gang decorator style, suitable for full range continuous variable control of luminaire light intensity.
2. Comply with UL 1472.
3. Preset slide style dimming control with a mechanical air-gap switch to totally disconnect power from the load when in the off position.
4. Compatible with luminaire ballast or driver.

2.3 DIGITAL LIGHTING CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products indicated on drawings or equivalent by one of the following:

1. Acuity nLight
2. Hubbell NX
3. Wattstopper DLM

B. Description: Intelligent control devices capable of operating in standalone control zones or in a networked configuration for remote, time-based, and global operation with inputs from digital signal sources and remote configuration and monitoring through a software interface.

C. System Architecture:
1. Free topology plug-in wiring with green (verify with Owner prior to shop drawings) Cat 5e network cabling for power and data between control devices, switches, and sensors.
2. Self-configuring, digitally addressable control devices.
3. Any combination of inputs shall be programmable to any number of control devices.
4. Automatic configuration and connection of room loads to the connected control devices in the space without commissioning or the use of any tools.
5. Units shall not have any dip switches or potentiometers for field settings.

D. Sensors, power packs, and wall stations shall be interconnected through RJ-45 ports and comply with General Requirements section specified herein.

E. System Accessories: Provide the following accessories as required for implementation of the control intent illustrated on the drawings.
1. Digital Plug Load Controllers: Self-configuring, single relay, 20A, 120V, on/off control.
2. Daylight Sensors: Shall be digital and comply with General Requirements section specified herein.
   a. Daylight sensor groupings: The set of zones that are controlled by a given daylight sensor shall be configurable through associated lighting relay room controller and shall not require manual wiring to modify.
   b. Daylight sensor settings: Settings associated with a given daylight sensor shall be adjustable through associated lighting relay room controller and shall not require any physical adjustment to the sensor itself.
3. Touchscreen: Customizable LCD capacitive touchscreen for on/off, dimming, zone, and scene control.
4. Handheld Remotes: On/off, dimming, and scene controller using IR communication, provide with wall holster.
5. Wireless Configuration Tools: Handheld remote for device setting programming, two-way IR communication.

6. Partition Switches: Indicates position of moveable partition for automatic grouping or separation of lighting in flexible use spaces.
7. Partition Controller: Provides manual or automatic coordination of spaces with up to four moveable walls by reconfiguring the connected digital switches and sensors.
8. I/O Module: Input / Output device. 24VDC relay with normally open, normally closed, and common outputs to indicate occupancy or lighting status to third party systems such as a BAS. Four input terminals for maintained or momentary switch closure inputs.
9. Serial Data Interface: Provides RS-232 interface with third party AV and/or shade control systems.
10. Relay Panels: Mechanically latching relays with individual manual override in steel enclosure. Digital integration with other system devices. Relay quantity, poles, and voltages per drawings.
11. BACnet Appliance: Provides BACnet MS/TP digital networked communication between rooms, panels, Gateway, or BAS and automatically creates BACnet objects representative of connected devices.
12. IP Gateway: BACnet to ethernet interface to allow web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
13. Programming and Configuration Software: PC-native application capable of accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

F. Sequence Control and Override: Networked systems utilizing astronomical, or time of day controls shall comply with the following.
1. Override control must allow any relay connected to it to be switched on or off by a manual switch or by an automatic switch, such as a sensor. Provide 2-hour override unless otherwise noted.
2. Override control "blink warning" must warn occupants approximately five minutes before actuating the off sequence. Does not apply to exterior lighting.
3. Activity log, storing previous relay operation, including the time and cause of the change of status.

G. Relays

1. Electrically operated, mechanically held, minimum 20 A rating at 120/277 VAC for single pole switches and 208/240/480VAC for double pole switches.
2. Integral manual ON/OFF switch with visual display of switch state.
3. Suitable for control of incandescent, fluorescent, LED, and HID loads.
4. Short-circuit current rating must not be less than available fault current as indicated in power system study.

H. Integral Power Supply: NFPA 70, Class 2, sized for connected equipment, plus 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, control-voltage inputs, and any field-installed sensors.

I. Push-Button and Key Operated Wall Station Switches: Modular, momentary contact or digital, for operating one or more relays and to override automatic controls.

J. Sensors and photocells: Powered from the lighting control relay panel, and signal compatible with the relay panel control unit. Comply with General Requirements section specified herein.

2.4 LIGHTING CONTACTOR CABINETS

A. Basis of Design: Subject to compliance with requirements, provide product indicated or equivalent product by one of the following:

1. Asco
2. Eaton
3. Square D

B. Description: Factory-wired and tested, lighting control cabinet with contactors, controls, and accessories in single enclosure.

C. Contactors: Electrically operated, dual acting single solenoid mechanism, mechanically held in both open and closed positions, combination-type remote control lighting contactors, complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: 30A up to 600VAC.
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Visual position indicator.
4. Control Coil Voltage: Match control power source.
5. Provide contactor capacity and configuration as required to accommodate switched zones shown on drawings plus 4 spares.

D. Control Modules: Solid State interface module, start/stop, two-wire, or three-wire control, mounted directly to contactors.

1. Integral auxiliary SPDT contacts to indicate position of the contactor.
2. Provide solid state control modules as necessary to interface with BAS/DDC systems, timers, photoelectric switches, and similar control devices as required by lighting control zones and sequences.

E. Enclosure: Comply with NEMA 250, Steel, NEMA 1 enclosure with hinged lockable cover cabinet enclosure sized as required for components, unless otherwise indicated. Mount switches and indicating lights required on front of enclosure. Install terminal strips for connection of all external control wiring connections. Surface or flush mounted as shown on drawings.

F. Provide the following integral control and indicating devices:

1. Hand-off-auto (HOA) selector switch, of the heavy-duty “oil-tight”, maintained-contact type, mounted on the front cover with legend plate.
2. Auxiliary SPDT contacts to indicate position of HOA switch.
3. Auxiliary relay to convert maintained-contact type control circuit to momentary-contact type control circuit necessary for contactor control.
4. Control transformer with primary voltage as indicated and 120-volt, single phase, 60 hertz secondary including fuse and fuse holder.
5. Green and Red pilot lights to indicate “Power ON” and “Power OFF” condition. Mount on front cover with legend plate.
6. Time Clock: Integral 365-day/7-day digital time clock with LCD display.
7. Photocell: Compatible with control voltage and complies with Outdoor Photoelectric Switches section specified herein.
8. Interface with BAS/DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting contactors.
    a. Monitoring: Contactor On-off status, HOA switch On, HOA switch Auto.
    b. Control: Contactor On-off operation.

2.5 ELECTRONIC DIGITAL TIME SWITCHES

A. Basis of Design: Subject to compliance with requirements, provide product indicated or equivalent product by one of the following:

1. Intermatic
2. Tork

B. Description: Electronic, solid-state programmable units with alphanumeric display complying with UL 916 and UL 917.

1. Contact capacity and configuration as required to accommodate switched zones and loads shown on drawings.
2. Contact Rating: 30-A, 120/277-VAC.
3. Operating Temperature: -40 to 155 deg F.
4. Enclosure: Steel, NEMA 3R outdoor, lockable.
5. Schedule: Astronomic 7-day/365-day dusk to dawn scheduling with up to 48 on and 48 off events per week and an annual holiday schedule that overrides the weekly operation on holidays.
6. Automatic daylight savings time changeover.
7. Adjustable switching configurations for simultaneous, independent, or pulse control of contacts.
8. 2-hour override buttons.
9. Backup power: Minimum 100-hour time and date retention.
10. Nonvolatile memory, to maintain programming after power loss.
11. USB connection for uploading, downloading, and transferring of programs

2.6 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:

1. Intermatic
2. Tork
3. Precision

B. Description: Solid state, 120-277VAC, with SPST dry contacts rated for 1800-VA, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
2. Time Delay: Fifteen second minimum, to prevent false operation.
3. Surge Protection: Metal-oxide varistor.
4. Mounting: Base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.
5. Enclosure: Outdoor weathertight housing, resistant to high temperatures, equipped with sun-glare shield, ice preventer, and directional lens to prevent fixed light sources from causing turn-off.
6. Failure Mode: Luminaire stays ON.

2.7 CONDUCTORS AND CABLES

A. Wiring to supply side of remote-control power sources: Not smaller than No. 12 AWG. Comply with requirements in Section 260519, Low-Voltage Electrical Power Conductors and Cables

B. Low-voltage control cable: Manufacturer's standard multi-conductor cable with stranded-copper conductors not smaller than No. 22 AWG, plenum rated unless otherwise recommended by the manufacturer.

C. Class 1 and 2 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 14 AWG, plenum rated unless otherwise recommended by the manufacturer.

D. UTP cabling: Unshielded, plenum rated, Cat5e twisted-pair cable. Comply with lighting control system manufacturer's recommendations.

2.8 SOURCE QUALITY CONTROL

A. Factory Tests and Inspections: Perform full-function testing on 100 percent of all system components and panel assemblies at the factory prior to delivery.

B. System control components shall be certified by the manufacturer to have been designed, manufactured, and tested for interoperability.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine lighting control devices and equipment before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.

B. Examine walls, ceilings, and other mounting surfaces for suitable conditions where lighting control devices and equipment will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lighting controls and equipment in accordance with manufacturer's written instructions, applicable requirements of NEC, and NECA 500 and 501.

B. Electrical installations shall conform to and meet IEEE C2, NFPA 70, and to the requirements specified herein.

C. Devices and Equipment shall be installed and programmed to meet the control intent.

D. Device Installation:

1. Comply with Section 262726 "Wiring Devices" for wall mounted device and faceplate installation requirements.
2. Install in a single box and provide a single cover plate where two or more devices are shown adjacent on plans. Provide voltage barrier where required.
3. Verify door swings with door frame installed prior to rough-in for switches and sensors. Locate switches on latch side of door.
4. Device Orientation: Install switches and dimmers with the "OFF" position down.

E. Panels and Cabinets:

1. Install panels and cabinets in accordance with NECA 407.
2. Mount top of trim no greater than 90-inches above finished floor unless otherwise indicated.
3. Mount panel cabinet plumb and rigid without distortion of box.

4. Install filler plates in unused spaces.

F. Conductors/Wiring:

1. Wiring Methods: Comply with Section 260519, Low-Voltage Electrical Power Conductors and Cables.
2. Size conductors in accordance with lighting control device manufacturer's instructions unless otherwise indicated.
3. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
4. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.
5. Provide plenum-rated cable, where installed exposed or in open cable tray, within environmental airspaces, including plenum ceilings.

G. Lighting Controllers/Power Packs:

1. Room controllers shall be surface mounted in accessible ceiling space above entry door. Install no higher than 6” above accessible ceiling.
2. Install controllers/power packs on the unswitched line side of local switches to keep sensors powered at all times.
3. Provide controllers/power packs(s) for each room/area/control zone for a working system.
4. Note all power pack locations and branch circuiting on as-built record drawings.

H. Lighting Contactors

1. Install lighting contactors as indicated on plan. Install at accessible locations.
2. Mount contactors in a manner to eliminate structure-borne vibration

I. Occupancy and Vacancy Sensors

1. Install wallbox sensors at switch height indicated on drawings,
2. Install wall sensors without manual switches at 8 ft above finished floor unless otherwise noted on drawings.
3. Install ceiling mounted sensors at locations indicated on manufacturer’s shop drawings. Sensor manufacturer shall provide quantity of sensors as required to provide complete coverage for rooms.
4. Locate sensors such that motion through open doors will not falsely activate sensors.
5. Do not locate ultrasonic sensors within six feet of supply air diffusers.
6. Locate infrared sensors to avoid obstructions.

3.3 IDENTIFICATION

A. Comply with Section 260553 "Identification for Electrical Systems."

1. Identify all components and power and control wiring.
2. Label time switches and contactors with a unique designation.
3. Provide directories inside relay panels and contactor cabinets that identify each relay and the associated control zone.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to perform system start-up, functional testing, and inspection of components, assemblies, and equipment installations, including connections.

B. Visual and Mechanical Inspections:

1. Upon completion of installation, verify that equipment is properly installed, connected, and adjusted.
2. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.

C. System Start-up:

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Confirm layout and location of sensors with manufacturer’s recommendations to achieve proper coverage of indicated areas. Provide additional sensors and control units as required to achieve complete minor motion coverage of the space indicated. Provide customizable sensor masks to block off unwanted viewing areas.
3. Confirm control schedules with owner including operating hours for each day of the week and holiday schedules. Submit to design team for approval.
4. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

D. System Functional Tests: After installing all control devices, automatic time switches, and sensors, and after electrical circuitry has been energized, test systems for compliance with approved sequences in accordance with energy code requirements.

1. Adjust time delays, trim settings, dead bands, and scene settings.
2. Owner and architect/engineer shall be present during adjustment of scene settings. Exterior scenes shall be adjusted during non-daylit hours.
3. Set and operate devices to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
4. Include testing of devices under conditions that simulate actual operational conditions including occupied and unoccupied states.
5. Verify all emergency lighting functions upon loss of power.
6. Record all control settings, operations, cues, and functional observations.

E. Nonconforming Work:

1. Lighting control devices and equipment will be considered defective if it does not pass tests and inspections.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace defective units and retest.
3. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

F. Prepare test and inspection reports.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose.

B. The lighting and lighting controls systems shall be synchronized and fully operable to address the lighting operation in a complete and code-compliant manner.

C. All ladders, scaffolds, lifts, gloves, cleaning cloths, access/adjustment tools, etc. required for aiming and adjusting lighting controls shall be furnished by the Contractor.

3.6 PROTECTION

A. Install lighting control devices after all wall preparation, including painting, is complete.

B. Replace all devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

C. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

D. Do not remove surface protection, such as plastic film and smudge covers, until final cleaning has been completed.

3.7 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's facility management and maintenance personnel, and selected Owner representatives. as specified below:
   1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of four (4) hours training.
   2. Training Aid: Use the approved final version of maintenance manuals as a training aid.
   3. Training shall include, but not be limited to, overview, adjustment, operation, use, maintenance, and demonstration of the lighting control system.

B. Software Service Agreement
   1. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
   2. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
      a. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

END OF LIGHTING CONTROL DEVICES

SECTION 26 22 00 - LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Section includes requirements for the provision of Low-Voltage, dry type distribution transformers including manufacturing, fabrication, configuration, and installation as required for the complete performance of the Work, as shown on the Drawings, as specified herein.

B. Section includes distribution, energy efficient, dry-type transformers with a nominal primary and secondary rating of 600 V and less.

C. Related Requirements:

1. Refer to Section 260500 “Common Work Results for Electrical Systems” for requirements related to equipment bases, supports, and vibration pads.

1.3 REFERENCES

A. Abbreviations

1. DOE: Department of Energy
2. FCAN: Full Capacity Above Normal
3. FCBN: Full Capacity Below Normal
4. XFMR: Transformer

B. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA)
   a. NECA 409, “Standard for Installing and Maintaining Dry-Type Transformers”.
2. National Electrical Manufacturers Association (NEMA)
   a. NEMA ST20, “Dry Type Transformers for General Applications”.
3. Underwriters Laboratories Inc (UL)
   a. UL 1561, “Dry-Type General Purpose and Power Transformers”.
4. Federal Regulations and Policies
   a. DOE 10 CFR Part 429, “Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment”.
   b. DOE 10 CFR Part 431, “Energy Efficient Program for Certain Commercial and Industrial Equipment”.

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 SUBMITTALS

A. Product Data: For each type of product. Include the following:

1. Basic Performance characteristics including insulation class, temperature rise, core and coil materials, impedances & audible noise level, unit weight, and inrush data expressed in either Amperes RMS or Times Rated input current.
2. Efficiency Data per NEMA ST20 and 10 CFR Part 431 at 35% loading point.
3. No load and full load losses calculated per NEMA ST20 test methods.
4. Efficiency levels at 25%, 50%, 75%, and 100% load points.

B. Shop Drawings: For each product type.

1. Enclosure dimensions and clearances
2. Wiring Diagrams: Power, signal, and control wiring.
3. Wire Bending Dimensions
4. Location for Ground Lug Provisions
5. Factory provided mounting brackets
6. Field installed accessories.

C. Factory quality-control test reports.
1. Acceptance Tests
2. Sound Level Tests

D. Field quality-control test reports.

E. Closeout Submittals

1. Provide Operation and Maintenance Data for transformers to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace access fencing, doors, lift-out panels, and structures as required to provide pathway for moving transformers into place.

B. Comply with manufacturer instructions for storage of electrical equipment to prevent damage from condensation or other environmental concerns.

1.7 COORDINATION

A. Coordinate size and location of concrete bases with dimensions of transformer provided.

B. Coordinate installation of wall and ceiling mounting hardware and structural supports with transformer provided.

C. Distribution equipment sizes and equipment layouts shall be considered basis of design. Equipment sizes vary by manufacturer. If proposed equipment is larger than the sizes illustrated, the burden shall be on the Contractor to provide equipment which fits in the space allotted while maintaining all code-required and manufacturer-recommended clearances.

D. Drawings indicate space available for electrical equipment, including clearances between equipment and adjacent surfaces and other items. Equipment installed must comply with all clearance, access and replacement working space requirements of the NEC and Owner.

E. Conduct and submit results of power system studies before submitting Product Data and Shop Drawings for electrical equipment.

F. Coordinate inrush current values of transformer provided with overcurrent protection device settings as described in Section 260573, “Power System Studies”. Adjust overcurrent protection device size, settings, and feeder size to eliminate nuisance operation in response to the actual transformer inrush current.

1.8 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace transformers, finishes, controls, wiring, and all of its components that fail in materials or workmanship within 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB/General Electric.
2. Eaton.
3. Siemens.
4. Square D.

B. Source Limitations: Obtain transformers and all other electrical distribution equipment through one source from a single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, NEMA ST 20, and list and label as complying with UL 1561.

C. Comply with (DOE) 10 CFR 431 for minimum energy efficiency levels. Transformers shall bear the UL Energy Efficiency Verification Mark to confirm that the unit meets minimum efficiency levels.

D. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

E. Phase, kVA Ratings, and Primary and Secondary Voltages: as indicated on drawings.

F. Cores: Grain-oriented, non-aging silicon steel with high permeability and low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below the saturation point to prevent core overheating.
1. One leg per phase.
2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
3. Visibly grounded to the enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
4. Cores shall be clamped with structural angles and bolted to the enclosure to prevent damage during shipment or rough handling.

G. Coils: Continuous windings without splices except for taps. Coils shall have a final wrap of electrical insulating material designed to prevent injury to the coil wire.
1. Coil Material: Copper.
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded.

H. Insulation Class: Minimum 220 deg C, UL-component-recognized insulation system.
1. Temperature Rise: 115 deg C unless noted otherwise.
2. All insulation materials shall be flame-retardant and shall not support combustion as defined in ASTM Standard Test Method D635
3. Wire left bare will not be accepted, all conductors must have insulation material.

I. Enclosure: Ventilated

1. NEMA 250, Type 2 unless otherwise required by environmental conditions. Provide weather shield for ventilation openings where located outdoors.
2. Heavy gauge steel construction.
3. The core and coil unit shall be completely isolated from the enclosure by means of a vibration isolating system and shall be so designed as to provide for continual securement of the core and coil unit to the enclosure.
4. Core and coil shall be encapsulated within non-hygroscopic thermosetting varnish, sealing out moisture and air.
5. Wiring Compartment: Sized for conduit entry and wiring installation.
6. Minimum clearances from ventilated openings to obstructions shall be indicated on the nameplate and not exceed 6-inches.
7. The maximum top of case temperature shall not exceed 35 deg C above 40 deg C ambient.
8. Finish: Gray weather resistant baked enamel, complying with NEMA 250.

J. Taps:

1. Three-phase transformers rated 15 kVA and larger shall be provided with six 2-1/2% full capacity taps, two above and four below rated primary voltage.
2. Three-phase transformers rated below 15kVA shall be provided with two 5% full capacity taps below rated primary voltage.

K. Grounding: Provide ground bar installed on the inside of the transformer enclosure.

L. Wall and Ceiling Brackets: Manufacturer's standard brackets.

M. Low-Sound-Level Requirements: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.

N. Terminations: Mechanical Lugs listed to accept specified wiring method, conductor size, and temperature rating.

2.3 SOURCE QUALITY CONTROL

A. Test and inspect transformers according to IEEE C57.12.91 and IEEE C57.12.91.

1. Ratio tests at the rated voltage connection and at all tap connections.
2. Polarity and phase relation tests on the rated voltage connection
3. Applied potential tests
4. Induced potential test
5. No-load and excitation current at rated voltage on the rated voltage connection

B. Factory Sound-Level Tests: Conduct prototype sound-level tests on equipment for this Project.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances and equipment operation required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install transformers level and plumb with vibration dampening supports.

1. Provide wall and ceiling mounted transformers with brackets fabricated by transformer manufacturer.
2. Coordinate installation of structural steel supports with actual transformer provided.

B. Construct concrete bases and anchor floor-mounted transformers according to manufacturer's written instructions.

C. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

D. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

C. Provide flexible connections at all conduit and conductor terminations and supports according to Section 260533, "Raceways and Boxes for Electrical Systems" and Section 260500, "Common Work Results for Electrical Systems" to eliminate sound and vibration transmission to the building structure.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

E. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553, "Identification for Electrical Systems".

1. Where primary disconnecting means is not provided within sight of transformer, identify transformer with equipment designation and location of remote lockable disconnecting means by permanent nameplate.
2. All distribution equipment shall be shipped from the manufacturer with factory-applied warning labels affixed to the outside front of the equipment (as it will be installed per the plans). All labeling shall be in compliance with NFPA 70 requirements.
3. Labels affixed to equipment by the equipment manufacturer shall comply with drawing and specification labeling requirements or shall be omitted by the manufacturer and field-installed by the Contractor. Labels which are factory-installed and not in compliance shall be removed and replaced and equipment enclosures refinished or replaced by the manufacturer to repair finish.

3.5 FIELD QUALITY CONTROL

A. Tests and Inspections: Perform the following tests and inspections. Certify compliance with test parameters.

1. Visual and Mechanical Inspection

a. Document equipment nameplate data on the test report. Verify that transformer nameplate ratings are in accordance with drawings.
b. Inspect the physical and mechanical condition of the equipment.
c. Inspect anchorage, alignment, and grounding.
d. Verify that resilient mounts are free and that any shipping brackets have been removed.
e. Inspect bolted electrical connections for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.

2. Electrical Tests

a. Perform insulation-resistance tests. Measurements shall be made from winding-to-winding and each winding-to-ground. Test voltages and minimum resistance shall be in accordance with manufacturer's published data.
b. Verify correct secondary voltage phase-to-phase and phase-to-neutral after energization and prior to loading.

B. Remove and replace units that do not pass tests or inspections and retest as specified above.

C. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.6 CLEANING:

A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF LOW-VOLTAGE TRANSFORMERS

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Section includes requirements for the provision of Panelboards including manufacturing, fabrication, configuration, and installation as required for the complete performance of the Work, as shown on the Drawings, as specified herein.

B. Section Includes:

1. Distribution panelboards
2. Lighting and appliance branch-circuit panelboards
3. Disconnecting and overcurrent protective devices.

C. Related Requirements:

1. Refer to Section 260500, “Common Work Results for Electrical Systems” for requirements related to equipment supports.

1.3 REFERENCES

A. Abbreviations

1. AFCI: Arc-fault circuit interrupter.
2. GFCI: Ground-fault circuit interrupter.
3. GFPE: Ground-fault protection of equipment.
4. MCCB: Molded Case Circuit Breaker
5. SWD: Switching Duty
6. VPR: Voltage protection rating.

B. Definitions

1. Panelboard: A single panel or group of panel units designed for assembly in the form of a single panel, including buses and automatic overcurrent devices, and equipped with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall, partition, or other support; and accessible only from the front.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA):

a. NECA 407, “Standard for Installing and Maintaining Panelboards"

2. National Electrical Manufacturers Association (NEMA):

a. NEMA AB 1, "Molded Case Circuit Breakers and Molded Case Switches."
b. NEMA PB 1, "Panelboards."
c. NEMA PB 1.1, "General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less."

3. Underwriter Laboratories (UL):

a. UL 50, "Enclosures for Electrical Equipment, Non-Environmental Considerations.”
b. UL 67, "Standard for Panelboards."
c. UL 489, "Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.”

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 SUBMITTALS

A. Product Data: For each type of panelboard,

1. Include materials, switching and overcurrent protective device, accessories, and component indicated.
2. Include manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.

C. Closeout Submittals

1. Operation and Maintenance Data: For Panelboards and components to include in operation and maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
   a. Routine maintenance requirements for panelboards and all installed components.
   b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices
   c. Time-current coordination curves for each type and rating of overcurrent protective device included in Panelboards.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of qualified workers as defined in NEMA PB 1.1 and trained in electrical safety as required by NFPA 70E.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1. Handle carefully to avoid damage to internal components, enclosure, and finish.

B. Comply with manufacturer instructions for storage of electrical equipment to prevent damage from condensation or other environmental concerns.

1.8 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Distribution equipment sizes and equipment layouts shall be considered basis of design. Equipment sizes vary by manufacturer. If proposed equipment is larger than the sizes illustrated, the burden shall be on the Contractor to provide equipment which fits in the space allotted while maintaining all code-required and manufacturer-recommended clearances.

C. Drawings indicate space available for electrical equipment, including clearances between equipment and adjacent surfaces and other items. Equipment installed must comply with all clearance, access and replacement working space requirements of the NEC and Owner.

1.9 WARRANTY

A. Manufacturer’s Warranty: Manufacturer agrees to repair or replace panelboards, circuit breakers, finishes, controls, components, and accessories that fail in materials or workmanship within 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB.
2. Eaton.
3. Siemens.
4. Square D.

B. Source Limitations: Obtain panelboards, overcurrent protection devices, and all other electrical distribution equipment through one source from a single manufacturer.

2.2 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70 and NEMA PB 1.

C. Provide circuit breaker type panelboards unless noted otherwise.

D. Enclosures: Flush- or surface-mounted, dead-front cabinets as indicated on drawings.

1. Rated for environmental conditions at installed location.
    a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    b. Outdoor and Wet Locations: NEMA 250, Type 3R.
    c. Corrosive and Wash Down Environments: NEMA 250, Type 4X.
    d. Kitchens: NEMA 250, Type 1 with Stainless Steel cover.
2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover
3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box and keep tight to wall with no gaps allowing access to live parts. Oversize trims will not be acceptable
4. Interior trim shall be of dead-front construction to shield user from all energized parts.
5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
6. Materials and Finishes:
    a. Panels, Back Boxes and Trim: Galvanized Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    b. Boxes: Galvanized steel with same finish as panels and trim. Unpainted galvannealed steel is not acceptable.
7. Boxes shall have removable end walls. End walls shall not be provided with concentric knockouts. Boxes shall have welded interior mounting studs. Interior mounting brackets are not required.
8. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
9. All lock assemblies shall be keyed alike.

E. Incoming Mains:

1. Circuit breaker or Lugs only as indicated on drawings
2. Location: Top or bottom to match feeder conduit entry.
3. Feeders routed through the side gutters to reach the top or bottom main breakers from the opposite end of the panel are not acceptable.
4. Main lugs or main breakers shall have barriers on five sides.

F. Phase, Neutral, and Ground Busses:

1. Material: Hard-drawn copper, 98 percent conductivity.

a. Bus shall be fully rated the entire length, with one continuous bus bar per phase.

2. Phase bussing shall be pre-drilled to accommodate field installable options.
3. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
4. Equipment Ground Bus: Extend full length of panelboard and adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
5. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. Provide where indicated on drawings.
6. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

G. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Tin-plated aluminum.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type.
6. Feed-Through Lugs: Where indicated provide mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device. Provide where indicated on drawings.
7. Subfeed (Double) Lugs: Where indicated provide mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus where indicated.

H. Service Entrance: Where panelboards are used as service equipment with one or more main service disconnecting and overcurrent protective devices, provide marking by an NRTL acceptable to authority having jurisdiction indicating panelboard is suitable for use as service equipment. Coordinate with utility company for any additional requirements.

I. Future Devices: Provide mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices. Where panelboards. are noted to have “space” or “space only”, this shall be prepared space with all bussing, lugs, etc. as required to accept future installation of over-current devices.

J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Panelboard and overcurrent protective device short circuit ratings shall be at least 110 percent of the actual available fault current.
1. Panelboards rated 240V or less: minimum 10,000 A.
2. Panelboards rated above 240V: minimum 14,000 A.

2.3 DISTRIBUTION PANELBOARDS

A. Panelboards: NEMA PB 1, power and feeder distribution type.

B. Provide bolt-on circuit breakers for overcurrent protective devices.

C. Doors: Secured with three point vault-type latch with tumbler lock; keyed alike. For doors more than 48 inches high, provide two latches.

D. All panelboards shall be capable of accepting 225 amp 3 pole branch breakers as a minimum unless otherwise noted.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

B. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

C. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

D. All panelboards shall have space to accept forty-two 20 amp single pole circuit breakers unless otherwise noted.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:
   a. Inverse time-current element for low-level overloads.
   b. Instantaneous magnetic trip element for short circuits.
   c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
2. Adjustable Instantaneous-Trip Circuit Breakers:
   a. Magnetic trip element with front-mounted, field-adjustable trip setting.
3. Electronic trip circuit breakers:
   a. RMS sensing.
   b. Field-replaceable rating plug or field-replicable electronic trip.
   c. Digital display of settings, trip targets, and indicated metering displays.
   d. Multi-button keypad to access programmable functions and monitored data.
   e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
   f. Integral test jack for connection to portable test set or laptop computer.
   g. Field-adjustable Instantaneous, Long- and short-time pickup, and Ground-fault pickup settings.
4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
5. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
6. AFCI Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
7. MCCB features and accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Breaker handle indicates tripped status.
   c. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
   e. Shunt Trip: 120 V or 24V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.

f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
g. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

B. Provide Ground Fault protection for circuit breakers rated 1000 A and higher on solidly grounded wye systems more than 150V to ground.

C. Provide Arc Flash energy reducing maintenance switch with local status indicator for circuit breakers rated 1200A and higher or where circuit breaker trip setting can be adjusted to 1200A or greater.

2.6 METERING

A. Where indicated comply with requirements in Section 260913, “Electrical Power Monitoring.”

B. Overcurrent Protective Device Communication Capability: Where indicated provide electronic trip circuit breakers and integral communication module with functions and features compatible with power monitoring and control system specified in Section 260913, "Electrical Power Monitoring".

2.7 SURGE PROTECTION DEVICES

A. Where panelboards are indicated with integral SPD, comply with requirements in Section 264300, “Surge Protective Devices”. Factory install SPDs prior to shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.

C. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work. Ensure area to receive panelboard has adequate clearance for panelboard installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

C. Temporary Lifting Provisions: Remove any temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Mount top of trim 90 inches above finished floor unless otherwise indicated or where required to maintain center of trip handle on overcurrent protection devices below 79-inches. Where mounted in groups, align top of trim or tub for all panels in an area.

E. Mount panelboard cabinet plumb and rigid without distortion of box.

F. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Provide steel slotted support structures where required for freestanding equipment or where building mounting surface is unsuitable.

H. Install overcurrent protective devices and controllers not already factory installed. Set field-adjustable, circuit-breaker trip ranges.

I. Install filler plates in unused spaces.

J. Stub four (4) 1-inch and two (2) 1-1/4-inch empty conduits from recessed panelboard into accessible ceiling space or space designated to be ceiling space in the future. Provide suitable closures for spare conduits and identify with a suitable label.

K. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

L. Comply with NECA 1.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553, “Identification for Electrical Systems” and as noted below:

1. Provide a directory card inside each door, covered with a plastic non-yellowing shield. Directory Card to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer to create directory in Microsoft Excel; handwritten directories are not acceptable. Digital versions to be provided to Owner.
2. The room numbers used to fill out the panel directories shall match the actual final name and numbering scheme selected by the Owner. They shall not be filled out per the construction drawing numbering scheme unless the Contractor is directed to do so by the Architect or Engineer.
3. Provide nameplate for each panelboard.
4. For distribution panelboards, provide nameplate for each branch circuit device.
5. All distribution equipment shall be shipped from the manufacturer with factory-applied warning labels affixed to the outside front of the equipment (as it will be installed per the plans). All labeling shall be in compliance with NFPA 70 requirements.
6. Labels affixed to equipment by the equipment manufacturer shall comply with drawing and specification labeling requirements or shall be omitted by the manufacturer and field-installed by the Contractor. Labels which are factory-installed and not in compliance shall be removed and replaced and equipment enclosures refinished or replaced by the manufacturer to repair finish.

3.5 FIELD QUALITY CONTROL

A. Perform the following Tests and Inspections:

1. Visual and Mechanical Inspection:

    a. Examine equipment nameplate data and confirm proper identification.
    b. Inspect the physical, electrical, and mechanical condition of the equipment and all components in accordance with the manufacturers' instructions.
    c. Inspect anchorage, alignment, and grounding.
    d. Inspect bolted electrical connections and terminations for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.
    e. Exercise all active components.
    f. Inspect all mechanical indicating devices for correct operation.
    g. Physically test key interlock systems to check for proper functionality prior to energizing.

2. Circuit Breaker Testing: For all circuit breakers with electronic trip units, determine minimum pickup current, long-time and short-time pickup and delay, and instantaneous pickup by secondary current injection. Certify compliance with test parameters and ensure settings match recommendations from final approved power system study.
3. Test ground-fault protection of equipment for service equipment per NFPA 70.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.7 ADJUSTING

A. Adjust moving parts and operable component to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573, “Power System Studies”.

C. All circuit breakers identified as spares shall be left in the OFF position.

END OF PANELBOARDS

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This section of the specifications covers all wiring devices and cover plates, standard, weatherproof and dust-tight.

B. Section Includes:

1. Straight Blade receptacles.
2. GFCI receptacles
3. USB receptacles
4. SPD receptacles
5. Twist-locking receptacles.
6. Controlled receptacles.
7. General use snap switches.
8. Manual Motor Control switches.
9. Wall Plates.
10. Cord and plug sets.
11. Floor service fittings.
12. Poke-through assemblies.
13. Prefabricated multioutlet assemblies.
14. Service poles.
15. Cord Reels.

1.3 REFERENCES

A. Abbreviations

1. CR: Corrosion Resistant
2. EMI: Electromagnetic interference.
3. GFCI: Ground-fault circuit interrupter.
4. IG: Isolated Ground
5. SPD: Surge Protective Device
6. TR: Tamper Resistant.
7. USB: Universal Serial Bus.
8. WR: Weather Resistant.

B. Definitions

1. Emergency Electrical Systems: Those systems legally required and classed as emergency by NFPA 70 Article 700, municipal, state, other codes, or by any government agency having jurisdiction.
2. Essential Electrical Systems: Those systems designed to ensure continuity of electrical power to designated areas and functions of a healthcare facility during disruption of normal power sources, and also to minimize disruption within the internal wiring system as defined by NFPA 70 Article 517 and NFPA 99.
3. Outlet: A point on the wiring system at which current is taken to supply utilization equipment.
4. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
5. Receptacle. A receptacle is a contact device installed at the outlet for the connection of an attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is two or more contact devices on the same yoke.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA):

   a. NECA 130, “Standard for Installing and Maintaining Wiring Devices"

2. National Electrical Manufacturers Association (NEMA)

   a. NEMA WD 1, “General Color Requirements for Wiring Devices”
   b. NEMA WD 6, “Wiring Devices—Dimensional Specifications”

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Schedules: List of legends and description of materials and process used for pre-marking wall plates.

C. Samples: Where requested by architect or engineer, one for each type of device and wall plate, in each color specified.

D. Closeout Submittals

1. Operation and Maintenance Data: For Wiring Devices to include in operation and maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:

   a. Manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide product indicated or equal from one of the following:

1. Eaton/Arrow Hart
2. Hubbell
3. Leviton
4. Pass & Seymour/Legrand

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Devices for Fixtures, Furnishings, and Equipment:
1. Receptacles: Match plug configurations.
2. Cord and Plug Sets: Match equipment requirements.

E. All terminations shall be side-wired clamping type. “Backstab” terminations or modular connectors are not permitted.

F. Device Color:

1. Wiring devices connected to normal power system: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
2. SPD Devices: Blue.
3. Isolated-Ground Receptacles: Orange or as specified above with orange triangle on face.

2.3 SPECIFICATION GRADE STRAIGHT-BLADE RECEPTACLES

A. Specification Grade Receptacle, Comply with NEMA WD 6, UL 498, FS W-C-596.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex	15A, 125V	NEMA 5-15R	Hubbell 5262
Duplex	20A, 125V	NEMA 5-20R	Hubbell 5362
Single	20A, 125V	NEMA 5-20R	Hubbell 5361

Duplex-TR	20A, 125V	NEMA 5-20R	Hubbell 5362TR
Duplex-IG	20A, 125V	NEMA 5-20R	Hubbell IG5362
Duplex-WR	20A, 125V	NEMA 5-20R	Hubbell 5362WR
Duplex-CR	20A, 125V	NEMA 5-20R	Hubbell HBL53CM62
Single	30A, 250V	NEMA 6-30R	Hubbell HBL9330
Single	50A, 250V	NEMA 6-50R	Hubbell HBL9367
Single	20A, 250V	NEMA 10-20R	Hubbell HBL9326

2.4 SPECIFICATION GRADE GFCI RECEPTACLES

A. Specification Grade GFCI Receptacles, Comply with UL 498, FS W-C-596, and UL 943 Class A.

B. Non-feed through type unless otherwise required, Integral self-testing GFCI with "Test" and "Reset" buttons and LED indicator light that is lighted when the unit is tripped. If critical components are damaged and ground fault protection is lost, power to receptacle shall be discontinued.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex GFCI	15A, 125V	NEMA 5-15R	Hubbell GFRST15
Duplex GFCI	20A, 125V	NEMA 5-20R	Hubbell GFRST20
Duplex GFCI with Alarm	20A, 125V	NEMA 5-20R	Hubbell GFRST20A
Duplex GFCI - TR	20A, 125V	NEMA 5-20R	Hubbell GFTRST20
Duplex GFCI - WR	20A, 125V	NEMA 5-20R	Hubbell GFTWRST20
Duplex GFCI - CR	20A, 125V	NEMA 5-20R	Hubbell GFRST52M
GFCI Blank Face	20A, 125V		Hubbell GFBFST20

2.5 USB RECEPTACLES

A. USB Charging Receptacle and Outlet, Comply with UL 1310, and USB 3.0 devices.

B. Dual port, combination USB Type A and C, 5 V dc, and 5 A per receptacle (minimum).

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex USB - TR	20A, 125V	NEMA 5-20R	Hubbell USB20AC5
Duplex USB - WR	20A, 125V	NEMA 5-20R	Hubbell USB20AC5WR

2.6 SPECIFICATION GRADE SPD RECEPTACLES

A. Specification Grade SPD Receptacles, Comply with UL 498, FS W-C-596, and UL 1449, Type 3:

B. Self-grounding. Integral SPD in line to ground, line to neutral, and neutral to ground. Visual and audible SPD indication, with LED indicator light visible in face of device to indicate device is "active" or "no longer in service.".

C. SPD Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 500 V and minimum single transient pulse energy dissipation of 340 J in each mode, according to IEEE C62.41.2 and IEEE C62.45.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex SPD	20A, 125V	NEMA 5-20R	Hubbell HBL5362SA

2.7 HOSPITAL-GRADE RECEPTACLES

A. Hospital-Grade Receptacles, Comply with requirements above and UL 498 Supplement SD:

B. Marking: Listed and labeled as complying with NFPA 70, Article 517 "Health Care Facilities".

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex	20A, 125V	NEMA 5-20R	Hubbell HBL8300H
Single	20A, 125V	NEMA 5-20R	Hubbell HBL8310
Duplex Tamper Resistant	20A, 125V	NEMA 5-20R	Hubbell 8300TRA
Duplex Isolated Ground	20A, 125V	NEMA 5-20R	Hubbell IG8300
Duplex GFCI	20A, 125V	NEMA 5-20R	Hubbell GFRST83
Duplex GFCI Tamper Res	20A, 125V	NEMA 5-20R	Hubbell GFTRST83
Duplex USB	20A, 125V	NEMA 5-20R	Hubbell USB8300AC5
Duplex SPD	20A, 125V	NEMA 5-20R	Hubbell 8362

2.8 TWIST-LOCKING RECEPTACLES

A. Twist-Lock, Single Receptacles, with matching plug as required by equipment. Comply with NEMA WD 6, UL 498, FS W-C-596.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single	20A, 125V	NEMA L5-20R	Hubbell HBL2310
Single	20A, 250V	NEMA L6-20R	Hubbell HBL2320
Single	20A, 277V	NEMA L7-20R	Hubbell HBL2330

2.9 CONTROLLED RECEPTACLES

A. Specification Grade Receptacle, Permanently marked and suitable for use with automatic switching means. Comply with NEMA WD 6, UL 498B, FS W-C-596.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Duplex Single Face Control	20A, 125V	NEMA 5-20R	Hubbell 5362C1TR
Duplex Two Face Control	20A, 125V	NEMA 5-20R	Hubbell 5361C2TR

2.10 GENERAL USE SNAP SWITCHES

A. Switches, 120/277 V, Comply with UL 20 and FS W-S-896.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221
Double Pole	20A, 120/277V		Hubbell 1222
Three Way	20A, 120/277V		Hubbell 1223
Four Way	20A, 120/277V		Hubbell 1224

B. Pilot-Light Switches, illuminated when switch is ON:

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221PL

C. Illuminated Switches, illuminated when switch is OFF:

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221IL

D. Key-Operated Switches, Factory-supplied key in lieu of switch handle:

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1221L
Three Way	20A, 120/277V		Hubbell 1223L
Four Way	20A, 120/277V		Hubbell 1224L

E. Double-Throw, Momentary-Contact, Center-off Switches.

TYPE	RATING	CONFIGURATION	BASIS OF DESIGN
Single Pole	20A, 120/277V		Hubbell 1557
Low Voltage	5A, 24VDC		Hubbell 1557LV

2.11 MANUAL MOTOR CONTROL SWITCHES

A. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle type for manual control of single or three phase motors up to 3/4 HP where overload protection is not required or is provided separately, marked to indicate whether unit is on or off.
   1. Standard: Comply with NEMA ICS 2, general purpose, Class A.

B. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle type with integral overload protection for use with single phase motors up to 1HP; marked to show whether unit is off, on, or tripped.
   1. Configuration: Non-reversing unless noted otherwise on drawings.
   2. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor and ambient temperature; external reset push button; melting alloy type.
   3. Red pilot light where indicated on drawings.
   4. HOA selector switch with dry contact inputs where indicated on drawings.

C. Provide with NEMA 1, NEMA 3R or other enclosure suitable for the location and atmosphere.

D. All manual starters located in finished areas shall be in flush-mounted enclosures.

2.12 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.

B. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

C. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.13 CORD AND PLUG SETS

A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.

B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.

C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.14 WALL PLATES

A. Single and combination types shall match corresponding wiring devices.
   1. Plate-Securing Screws: Metal with head color to match plate finish.
   2. Material for Finished Spaces: satin-finished, type 304 stainless steel.
   3. Material for Unfinished Spaces: satin-finished, type 304 stainless steel.
   4. Material for Rough Service Locations including gymnasiums, kitchens, mechanical rooms, material management, and food service areas: satin-finished, Type 304 stainless steel.
      a. For kitchen and food service areas, provide foam gasket behind plate to help prevent water infiltration.

B. Material for Interior Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

C. Wet-location, Weatherproof, in-use cover plates: extra duty, suitable for use with and decorator style devices, die-cast aluminum lockable cover, self-closing, gasketed, standard box mounting.
   1. Vertical mounting - Hubbell WP26E or equal.
   2. Horizontal mounting - Hubbell WP26EH or equal.

D. Cover plates for lighting control devices exposed to severe physical damage (gymnasiums): Low profile, flip-up clear polycarbonate cover. STI Stopper or equal.

2.15 FLOOR BOXES AND POKE-THROUGH ASSEMBLIES

A. Description: Single or multi-service, recess activated, multi-gang floor outlet with devices capable of supplying combinations of power, data, voice, and AV services in a single assembly.

B. Manufacturers: Subject to compliance with requirements, provide product indicated on drawings or approved equal by one of the following:
   1. FSR
   2. Hubbell
   3. Legrand (Wiremold)

C. Floor Boxes and Poke-Thru Assemblies
1. Comply with UL514A.
2. Material: Cast metal or sheet metal with finished interior
3. Type: Fully adjustable before and after floor installation.
4. Shape: Rectangular or Round
5. Designed for use with industry standard wall plates, devices, and modular inserts.
6. Painted with corrosion resistant fusion-bonded epoxy where used in on-grade floor applications.
7. Classified for fire resistance up to 2 hours where used in rated floors.
8. Evaluated by UL to meet U.S. safety standards for scrub water exclusion.
9. Provide separate paths for management of telecommunications and power cables in compliance with NFPA 76.
10. Cover: ADA-compliant, with less than 0.15-inch rise to cover flange, hinged for 180-degree opening, Gasketed, Die-cast powder coated aluminum suitable for multiple floor surfaces.
    a. Surface style for carpet and VCT floor finishes.
    b. Flush style for wood, tile, finished concrete, and terrazzo floor finishes.

2.16 PREFABRICATED MULTIOUTLET ASSEMBLIES

A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.

B. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

C. Raceway Material: Metal, with manufacturer's standard finish.

D. Multioutlet Harness:
1. Receptacles: 20-A, 125-V.
2. Receptacle Spacing: 18 inches unless noted otherwise.
3. Wiring: No. 12 AWG solid, Type THHN copper.

2.17 SERVICE POLES

A. Dual-Channel Service Poles
1. Description: Factory-assembled and -wired units to route power and communications cabling from connections above ceiling to outlets below ceiling.
2. Listed and labeled in accordance with UL 5 for exposed power raceway and fittings, and UL 2024 for communications raceway and fittings.
3. Poles: Minimum 2.5-inch- square cross-section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
4. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
5. Material: Aluminum.
6. Finishes: Manufacturer's standard painted finish and trim combination.
7. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, balanced twisted pair data communication cables.

2.18 CORD REELS

A. Description: Reel equipped with, or intended for use with, length of flexible cord, providing means for cord to be unwound by user as desired, providing spring take-up mechanism to rewind cord on reel, and providing latch to restrain action of spring take-up mechanism while cord reel is in use.

B. Comply with UL 355.

C. Spring Driven, suitable for industrial and commercial use, No. 12 AWG conductors, 20A rating, Black aluminum housing, Ball stop, pivot base, 40ft spool capacity with double 20A duplex receptacles unless noted otherwise.

PART 3 - EXECUTION

3.1 APPLICATION

A. Receptacles and cover plates shall be listed for the installed environment.

1. Provide corrosion resistant devices where exposed to corrosive environment such as pools and natatoriums.

B. Outdoor receptacles and receptacles located in wet locations shall be weather resistant, GFCI type, with weather proof enclosure.

C. Provide GFCI receptacles in the following locations in addition to the locations noted on the drawings:

1. Bathrooms
2. Kitchens and food preparation or cooking areas
3. Rooftops
4. Outdoor/Exterior Locations
5. Within 6 feet of sinks, tubs, showers stalls, eyewash stations, and emergency showers
6. Indoor Wet and Damp locations
7. Locker Rooms and Showers
8. Maintenance Shops, garages, and service bays.
9. Crawlspaces at or below grade
10. Unfinished areas of basements
11. Mechanical/Janitor Rooms
12. Laundry areas

D. Provide weather-resistant rating for GFCI receptacles installed in wet locations.

E. Where GFCI receptacles are located in areas that are not readily accessible, provide GFCI blank face device in readily accessible location approved by Architect.

F. Provide GFCI receptacles with audible alarm for refrigeration and vending applications.

G. Provide tamper resistant outlets in all areas.

3.2 INSTALLATION

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' instructions, comply with installation instructions in NECA 130.

B. Mounting Heights: Unless otherwise indicated in Contract Documents, comply with mounting heights recommended in NECA NEIS 1.

C. Devices that have been installed before painting shall be masked. No plates or covers shall be installed until all finishing and cleaning has been completed. Replace stained or improperly painted wiring devices and coverplates.

D. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required. Where GFCI receptacles share a single circuit with other devices, a ground fault on any GFCI receptacle shall not interrupt power to downstream devices.

E. Coordination for all receptacles: Confirm receptacle configuration of all special purpose receptacles with approved submittals prior to installation and provide devices to match equipment plugs. Contractor shall replace any incompatible receptacle discovered during owner move-in.

F. Coordination with Other Trades:

1. Adjust locations of outlets to suit arrangement of partitions and furnishings. Locate outlets to avoid blocking by supports, furnishings, and other architectural fixtures.
2. Adjust locations of floor boxes and poke-throughs to coordinate with locations of structural members, concealed piping, and concealed conduit.
3. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
4. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
5. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
6. Install wiring devices after all wall preparation, including painting, is complete.

G. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Where re-using existing conductors:
   a. Cut back and pigtail or replace all damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.

H. Device Installation:

1. Replace all devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until all finish work is complete.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. Use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
7. When conductors larger than #12 AWG are installed on 15- or 20-A circuits, splice #12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
10. Install devices and assemblies' level, plumb, and square with building lines. Align devices vertically and horizontally. Securely fasten devices into boxes.

I. Device Orientation:

1. Install switches with "OFF" position down.
2. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the left so the neutral blade is at the top.

J. Device Plates:

1. Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
2. All outlets not provided with wiring devices shall be closed with a blank plate matching other plates in the area.
3. Align coverplate mounting screw slots in the same direction, either vertical or horizontal. Do not overtighten coverplate mounting screws. Overtightening can cause the coverplate to warp, dimple, bend, and in the case of plastic faceplates, crack, or break.

3.3 IDENTIFICATION:

A. Comply with Section 260553 "Identification for Electrical Systems."

1. All device wall plates shall be labeled with panel and circuit designation by means of machine printed adhesive tape. Select face plates shall be engraved. Refer to drawings.
2. All device boxes shall have circuit number and panelboard identified within the box.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Using a test plug, perform the following tests and inspections for receptacles:

1. Insert and remove test plug to verify that devices are securely mounted.
2. Verify correct configuration of hot, neutral, and ground pins.
3. Verify correct operation of ground fault protective devices.

C. Nonconforming Work:
1. Device will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective units and retest.

D. Prepare test and inspection reports.

END OF WIRING DEVICES

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Provide labor, material, equipment, related services, and supervision required for the installation of cartridge fuses where utilized for overcurrent and/or current limitation applications.

B. Section Includes:

1. Cartridge fuses rated 600V-AC and less for use in control circuits, enclosed switches, panelboards, switchboards, and motor controllers.
2. Spare fuse cabinet.

1.3 REFERENCES

A. Definitions

1. Fuse: A protective device that opens a circuit during specified overcurrent conditions by means of a current responsive element.

B. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA)
   a. NECA 420, “Fuse Applications”

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 SUBMITTALS

A. Product Data: For each fuse type indicated:

1. Include let-through current curves for fuses with current-limiting characteristics.
2. Time-current curves, coordination charts and tables, and related data.

B. Ambient Temperature Adjustment Information: Where ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
2. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

C. Closeout Submittals

1. Operation and Maintenance Data: For Fuses include in emergency, operation, and maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
   a. Let-through current curves for fuses with current-limiting characteristics.
   b. Time-current curves, coordination charts and tables, and related data.
   c. Ambient temperature adjustment information.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels indicated in power system study.

1.7 MAINTENANCE MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to one spare for every 10 installed units, but not less than 5 units for each size and type.
2. Fuse Pullers: Two for each size and type.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to replace fuses that fail in materials or workmanship within 12 months from date of Substantial Completion.

1.9 FIELD CONDITIONS

A. Where ambient temperature to which fuses are exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann, Inc.

2. Littlefuse, Inc.
3. Mersen USA.

B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with:

1. NEMA FU 1 – Low Voltage Cartridge Fuses.
2. UL 248 – Standard for Low Voltage Fuses.
3. UL 512 – Fuseholders.

2.3 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, current limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 250 or 600-V, zero- to 600-A rating, 200 kAIC minimum, fast acting or time delay.
2. Type RK-5: 250 or 600-V, zero- to 600-A rating, 200 kAIC minimum, fast acting or time delay.
3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC minimum, fast acting or time delay.
4. Type L: 600-V, 601- to 6000-A rating, 200 kAIC minimum, time delay option.

B. Voltage: Rating suitable for circuit phase-to-phase voltage.

C. Provide dual element fuses with separate overload and short circuit elements.

2.4 SPARE-FUSE CABINET

A. Manufacturer: Bussmann #SFC-FUSE-CAB spare fuse cabinet or equal.

B. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2 inch high white letters on black lamicoid plate. Mount plate on exterior of door.
4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPICATIONS

A. Service, Feeders, and Branch Circuits (601-6000A): Class L, time delay. Bussmann HI-CAP Fuses KRP-C or equal. Fuses shall hold 500% of rated current for a minimum of 4 seconds.

B. Feeders and Branch Circuits (0-600A): Class RK1, time delay. Bussmann Low-Peak Dual Element Fuses, LPN-RK (250 volts) or LPS-RK (600 volts) or equal. The fuse shall hold 500% of rated current for a minimum of 10 seconds.

C. Motor Circuits – Class RK1 or Class L, time delay as indicated above.

1. Motor with 1.15 service factor: Size at 125% of motor FLA. For high inrush current applications size 150% to 200% of motor FLA.
2. Motor with 1.0 service factor: Size at 115% of motor FLA.

D. Control Circuits: Class CC, time delay. Bussmann Low-Peak Fuses LP-CC or equal. Fuses shall hold 200% of rated current for a minimum of 12 seconds.

E. Adjust fuse type and selection as required to ensure available fault current at equipment controllers indicated in power systems study does not exceed labeled SCCR values.

3.3 INSTALLATION

A. Fuses shall be shipped separately. Any fuses shipped installed in equipment, shall be replaced by the Electrical Contractor with new fuses as specified above prior to energizing at no additional expense to Owner. All fuses shall be stored in moisture free packaging at job site and shall be installed immediately prior to energizing of the circuit in which it is applied.

B. No fuses shall be installed in the equipment until the installation is complete, including tests and inspections required prior to being energized. All fuses shall be of the same manufacturer to ensure retention of selective coordination, as designed.

C. Provide a complete set of fuses for all fusible devices. Arrange fuses so rating information is readable without removing fuse.

D. Install spare-fuse cabinet(s). Locate in Main Electrical Room.

E. Upon completion of the building, the Contractor shall provide the Owner with spare fuses in Spare-Fuse Cabinet.

3.4 IDENTIFICATION

A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems".

1. Indicate fuse rating and type on the outside door of each fused switch.

END OF FUSES

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: Section includes requirements for the provision of individually enclosed switches and circuit breakers including manufacturing, fabrication, configuration, and installation as required for the complete performance of the Work, as shown on the drawings and specifications

B. Section includes:

1. Fusible and Non-Fusible Switches.
2. Enclosed Circuit Breakers.
3. Elevator Shunt trip switches.
4. Enclosures.

1.3 REFERENCES

A. Abbreviations

1. HD: Heavy Duty
2. MCCB: Molded Case Circuit Breaker
3. NC: Normally Closed
4. NO: Normally Open
5. SCCR: Short Circuit Current Rating

B. Definitions

1. Disconnect: A switch, device, group of devices, or other means used to disconnect conductors of a circuit from their source of supply.
2. Switch (switching device): A device, manually operated, unless otherwise designated, for opening and closing or for changing the connection of a circuit. Also referred to as safety switches or disconnect switches.

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 SUBMITTALS

A. Product Data: For each product type.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Short-circuit current ratings (interrupting and withstand, as appropriate).
3. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For each type of enclosed switch, circuit breaker, accessory, and component indicated.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types and details for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of overcurrent protective devices.
5. Include evidence of NRTL listing for series rating of installed devices.
6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
7. Include wiring diagrams for power, signal, and control wiring.
8. Cable terminal size and quantity.

C. Closeout Submittals

1. Operation and Maintenance Data: For enclosed switches and circuit breakers include in emergency, operation, and maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
   a. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.6 COORDINATION

A. Product Selection for Restricted Space: Drawings indicate space available for enclosed switches including clearances between enclosed switches and adjacent surfaces and other items. Furnish and install equipment to comply with NEC clearances.

1.7 WARRANTY

A. Manufacturer’s Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace devices that fail in materials or workmanship within 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB/General Electric.

2. Eaton Electrical Inc.
3. Siemens.
4. Square D

B. Source Limitations: Obtain enclosed switches, overcurrent protection devices, and all other electrical distribution equipment through one source from a single manufacturer unless approved otherwise.

2.2 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Service-Rated Switches and Circuit Breakers: Labeled for use as service equipment.

D. Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Switch and overcurrent protective device short circuit ratings shall be at least 110% of the actual available fault current.

2.3 FUSIBLE AND NON-FUSIBLE SWITCHES

A. Type HD, Heavy Duty, Single Throw, 250-VAC, or 600-VAC, 1200 A and Smaller unless noted otherwise.

B. Quick-make, quick-break operating handle and switch mechanism integral to box.

C. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate fuses where indicated.

D. Externally operable dual interlocked handle to prevent opening front cover with switch in ON position, or closing switch when door is open. Visible load interrupter knife switch blades in the off position with door open.

E. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.

F. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

G. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: UL Listed, mechanical type, front removeable, and suitable for number, size, and conductor material at 75 deg C.
4. Auxiliary Contact Kit: NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating as required for application.

5. Electrical Interlock Kit: Pivot arm operated from the switch mechanism, breaking a control circuit before the main switch blades break.

H. For receptacle switches provide interlocking linkage between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

2.4 ENCLOSED MOLDED-CASE CIRCUIT BREAKERS

A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. MCCBs shall be equipped with a device for locking in the open position.

E. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:

1. Long-time, Short-time, and Instantaneous trip unless noted otherwise on drawings.

G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.

H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single-, two-pole, and three-pole configurations with Class A ground-fault protection (6-mA trip).

I. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

J. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: UL Listed, mechanical type, suitable for number, size, trip ratings, and conductor material at 75 deg C.
3. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact. Coordinate coil voltage and provide control circuits as required for application.

2.5 ELEVATOR SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann
2. Littlefuse
3. Mersen

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses.

E. Accessories:
1. Key switch for key-to-test function.
2. Red ON pilot light.
3. Isolated neutral lug.
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three-pole, double-throw, fire-safety, and alarm relay; 24-V dc coil voltage.

F. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

2.6 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor and Wet Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 3R, stainless steel.

B. Enclosure Finish: The enclosure shall be finished with the standard manufacturer gray finish.

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Securely fasten each switch and circuit breaker to the supporting structure or wall, utilizing a minimum of four (4) 1/4-inch bolts. Do not mount in an inaccessible location or where the passageway to the switch may become obstructed.

D. After equipment has been installed, inspected, and is ready to be energized, install fuses in fusible devices in accordance with equipment nameplates and Section 262816, “Fuses”.

E. Comply with NFPA 70 and NECA 1.

F. Provide electrical interlock kit and low voltage wiring where utilized on the line side of VFD controller to shut down VFD prior to disconnection of power. Coordinate control wire termination with Division 25.

G. Provide electronic trip breakers where required to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

H. Provide fusible switches with current limiting fuses or current limiting circuit breaker for equipment disconnecting means where equipment short circuit current rating is insufficient for available fault current.

I. Where battery lowering devices are specified with Hydraulic Elevators, provide connection between an auxiliary contact at the elevator disconnect and the battery lowering device.

3.3 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.4 IDENTIFICATION

A. Comply with requirements in Section 260553, “Identification for Electrical Systems”

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
2. Label each enclosure with nameplate.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Visual and Mechanical Inspection:
    a. Examine equipment nameplate data and confirm proper identification.
    b. Verify and record fuses sizes and types are in accordance with nameplates and power systems study.
    c. Inspect the physical, electrical, and mechanical condition of the equipment and all components in accordance with the manufacturers' instructions.
    d. Inspect anchorage, alignment, and grounding.
    e. Inspect bolted electrical connections and terminations for high resistance by verifying tightness with calibrated torque-wrench method in accordance with manufacturer's published data.
    f. Exercise all active components to ensure proper mechanical operation.
    g. Check all interlocking systems for correct operation.
2. Circuit Breaker Testing: For all circuit breakers with electronic trip units, determine minimum pickup current, long-time and short-time pickup and delay, and instantaneous pickup by secondary current injection. Certify compliance with test parameters and ensure settings match recommendations from final approved power system study.
3. Test ground-fault protection of equipment for service equipment per NFPA 70.
4. Test all auxiliary devices/system interfaces and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Switches and Circuit Breakers will be considered defective if they do not pass tests and inspections.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Prepare test and inspection reports, including a certified report that identifies switches and circuit breakers included and that describes results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Power System Studies".

END OF ENCLOSED SWITCHES AND CIRCUIT BREAKERS

SECTION 26 29 00 - MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY:

A. Extent of motor starter work is indicated by drawings and schedules.

B. Section includes:

1. Combination full voltage, non-reversing Motor Controllers.
2. Combination Soft Start Motor Controllers

C. Related Requirements:

1. Refer to Section 260500 “Common Work Results for Electrical Systems” for additional requirements related to motors connections.
2. Refer to Section 262726 “Wiring Devices” for information on manual motor controllers.
3. Refer to Division 25 for coordinating requirements related to control system interface points.

1.3 REFERENCES

A. Abbreviations

1. FVNR: Full Voltage Non-Reversing
2. MCP: Motor Circuit Protector
3. OCPD: Overcurrent protective device
4. SCCR: Short Circuit Current Rating
5. SCPD: Short-circuit protective device
6. SCR: Silicon Controlled Rectifier

B. Definitions

1. Soft Starter: Solid state reduced voltage non-reversing motor controller

1.4 SEQUENCING

A. Submit the preliminary power system study prior to receiving final approval of equipment and system protective devices submittals and prior to release of equipment drawings for manufacturing. Adjust equipment sizes, frame sizes, and trip units as necessary to achieve performance requirements outlined in Section 260573, “Power Systems Studies”.

1.5 SUBMITTALS:

A. Product Data: For each type of product.

B. Shop Drawings: For each type of product.

1. Include wiring diagrams for signal and control wiring. Clearly identify manufacturer-installed and field installed wiring.
2. Include features and factory settings of individual protective devices and auxiliary components.

C. Closeout Submittal:

1. Operation and Maintenance Data: For motor controllers to include in operation and maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
   a. Routine maintenance requirements for magnetic controllers and installed components.
   b. Manufacturer's written instructions for testing and adjusting circuit breaker and motor circuit protector trip settings.
   c. Manufacturer's written instructions for setting field-adjustable overload relays.
   d. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.6 MAINTENANCE MATERIAL

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Equal to one spare for every 10 installed units, but not less than 5 units for each size and type.
2. Overloads: Equal to one spare for every 9 installed units, but not less than 3 units for each size and type.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace enclosures, starters, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within 12 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS:

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

B. UL Compliance and Labeling: Fabricate and label motor controllers to comply with UL 508.

C. NEC Compliance: Comply with NEC as applicable to wiring methods, construction and installation of motor starters.

D. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to motor controllers/starters and enclosures.

2.2 MANUFACTURERS:

A. Manufacturer: Subject to compliance with requirements, provide products from one of the following:

1. ABB/General Electric
2. Allen Bradley Co.
3. Eaton
4. Siemens.
5. Square D. Co.

2.3 MANUAL MOTOR CONTROLLERS

A. Refer to Section 262726 “Wiring Devices” for manual motor controller requirements.

2.4 COMBINATION FULL VOLTAGE MOTOR CONTROLLER

A. Description: Factory-assembled, combination full-voltage, non-reversing magnetic motor controller consisting of the controller, indicated disconnecting means, SCPD, OCPD, pushbuttons, selector switch(es), and indicator lights in a single enclosure.

B. All combination starter/disconnect switches shall have low-voltage protection, solid state overloads, start / stop pushbuttons, Hand-Off-Auto selector switch and Red and Green pilot lights.

C. All combination starter/disconnect switches shall be Type HD, Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Combination motor starters shall be rated in accordance with NEMA sizes and horsepower ratings. No starter shall be listed as a fractional size. Contactor contacts shall be silver alloy, double break, and shall allow for inspection on NEMA Sizes 00 through 4 without the use of tools. Size 5 and larger shall allow for inspection utilizing standard tools. They shall be replaceable without removing the line, load, or control wiring from the starter, and replaceable without removing the starter from the enclosure.

E. Contactor coils shall be the encapsulated type and shall be replaceable on NEMA Sizes 00 through 4 without the use of tools. Size 5 and larger shall be replaceable with standard tools. They shall be replaceable without removing the line, load, or control wiring from the starter, and replaceable without removing the starter from the enclosure.

F. Overload protection shall be provided by solid state electronic overload relay. Single-phase starters shall provide one- or two-leg overload protection; three-phase starters shall provide three-leg overload protection. Overload protection shall be class 10/20 selectable, have visible trip indicator, and manual or remote reset function.

G. Starter shall include phase failure relay with under-voltage protection.

H. Starter shall have integral controls transformer with primary and secondary fusing.

I. Starter to have two normally closed and two normally open auxiliary contacts.

J. Combination starter shall be suitable for straight through wiring.

K. Fusible Disconnecting Means: Heavy Duty, quick-make, quick-break, load break rated, such that during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing and opening action of the contacts has started. The handle and mechanism shall be an integral part of the box (not cover) with facilities for pad locking in the open or closed position with up to three padlocks. Switch doors shall be interlocked with switch handle so that the door can only be opened when the switch is in the "OFF" (open) position.

L. All safety switches shall have a factory installed neutral lug, when a neutral is necessary.

M. All current carrying parts shall be plated by an electrolytic process to resist corrosion and to promote cooling.

N. Provide the following Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.5 COMBINATION SOFT START MOTOR CONTROLLER

A. Description: Factory Assembled, Solid state, reduced voltage, non-reversing motor controller consisting of controller, disconnecting means, protection devices, microprocessor with digital keypad in a single enclosure.

B. Enclosure shall include a door mounted digital keypad for adjusting the soft starter parameters and viewing process values and viewing the motor and soft starter status without opening the enclosure door. Provisions shall be available for padlocking the enclosure door.

C. The enclosed product shall be provided with molded case disconnect switch and in-line fuse block for Class J power fuses from 10 to 600A or Class L power fuses from 601 to 1600A for Type 1 short circuit protection.

D. The motor must be automatically protected from solid state component failure by an isolation contactor that opens when the motor is stopped or when the controller detects a fault condition including a shorted SCR.

E. The soft starter shall utilize an SCR bridge consisting of at least two SCRs per phase to control the starting and stopping of industry standard motors.

F. The soft start shall provide torque control for linear acceleration independent of motor load or application type without external feedback. The gating of the SCRs will be controlled in such a manner to ensure stable and linear acceleration ramp.

G. The soft starter shall be controlled by a microprocessor that continuously monitors the current and controls the phasing of the SCRs. Analog control algorithms shall not be allowed.

H. A shorting contactor shall be standard on soft starters in all enclosure configurations. Protective features and deceleration control options integral to the soft starter shall be available even when the shorting contactor is engaged.

I. The SCRs shall have a minimum P.I.V. rating of 1800 Vac. Lower rated SCRs with MOV protection are not acceptable.

J. All programming/configuration devices, display units, and field control wiring terminals shall be accessible on the front of the control module. Exposure to control circuit boards or electrical power devices during routine adjustments is prohibited.

K. Digital indication shall provide, as a minimum, the following conditions:

1. Soft starter status - ready, starting/stopping, run.
2. Motor status - current, torque, thermal state, power factor, operating time, power in kW.
3. Fault status - Motor thermal overload, soft starter thermal fault, loss of line or motor phase, line frequency fault, low line voltage fault, locked rotor fault, motor underload, maximum start time exceeded, external fault, serial communication fault, line phase reversal fault, motor overcurrent fault.

L. The soft starter must be preset to the following for adjustment-free operation in most applications:

1. Linear (torque-controlled) acceleration ramp of 15 seconds.
2. Current limitation to 400% of the motor full load current rating.
3. Class 10 overload protection.
4. Motor current preset per NEC / NFPA 70 table 430.150 for standard hp motors.

M. A digital keypad shall be utilized to configure operating and controller parameters such as FLA, acceleration ramp, torque, braking type, thermal overload Class, reset functions, etc.

N. Provide output relays to provide the following status indications:

1. One Form A (N.O.) minimum for indication of fault.
2. One Form A (N.O.) for indication that acceleration ramp is complete, and current is below 130% motor FLA (end of start).
3. One Form A (N.O.) assignable to one of the following functions: motor thermal alarm, motor current level alarm, and motor underload alarm.

O. A microprocessor-based thermal protection system shall be included which continuously calculates the temperature-rise of the motor and soft starter and provides:

1. A motor overload pre-alarm that indicates by relay contact or logic output that the motor windings have exceeded 130% of its rated temperature rise. This function shall be for alarm only.
2. A motor overload fault will stop the motor if the windings have exceeded 140% of temperature-rise.
3. An electronic circuit with a time-constant adjustable to the motor's thermal cooling time-constant ensuring the memorization of the thermal state even if power is removed from the soft starter.
4. The soft starter shall provide line and motor phase loss, phase reversal, underload, stall, and jam protection.
5. The integral protective features shall be active even when the shorting contactor is used to bypass the SCRs during steady state operation.
6. The soft starter control circuit shall be fed from the line supply and be completely independent of the power circuit and separate from the control logic.

P. The peripheral soft starter control circuitry shall be operated at 120 Vac 60 Hz from a control power transformer included within the enclosure.

Q. Operator devices shall be door mounted and shall be:

1. Red STOP and black START push buttons.
2. Three position H-O-A switch which provides for manual (HAND) start or remote signal (AUTO) start from user-supplied relay contacts.
3. Three position FWD-OFF-REV switch provides forward, off and reverse selector switch mounted on the door (available with reversing starter only).
4. Red RUN pilot light illuminated whenever the soft starter is provided a run command and no-fault condition is present.
5. Green OFF pilot light illuminated whenever the soft starter is supplied with control power and no run command is present.
6. All operator devices shall be remote-mounted using supplied 120 Vac control logic. Clearly labeled terminals shall be provided for field installation.

R. Provide a shorting contactor that shall close, shorting the SCRs after the acceleration ramp is compete and motor current is below 130% of motor FLA, and open on a stop command to allow a deceleration ramp. Overload protection integral to the soft starter shall continue to protect the motor when shorting is engaged. A microprocessor shall control the operation of the shorting contactor via an output relay.

S. Provide full voltage bypass starter with overload protection to provide motor operation in the event of soft starter failure. Provide “NORM/BYPASS” selector switch on enclosure door.

PART 3 - EXECUTION

3.1 MOTOR CONTROLLER APPLICATION

A. FVNR and Soft Starter type motor controllers shall be combination type starter and disconnect switch unless noted otherwise on plans.

B. Starters smaller than 10HP shall be full voltage non-reversing type (FVNR). Starters 10HP and larger shall be soft starters.

C. SCCR ratings shall exceed the available fault current calculated by the power system study as required by Section 260573, “Power System Studies”.

D. The starter shall be designed to operate in the environment in which installed including ambient temperature, humidity, and elevation.

E. Enclosure:

1. Type of each starter to comply with environmental conditions at installed location:
   a. Indoor, Dry and Clean Locations: NEMA 250, Type 1
   b. Outdoor Locations: NEMA 250, Type 3R.
   c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
2. Provide provisions for padlocking the enclosure door.

3.2 EXAMINATION

A. Examine elements and surfaces to receive motor starters for compliance with installation tolerances, relationship to motors, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.3 INSTALLATION OF MOTOR CONTROLLERS:

A. Install motor starters as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA standards, and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Securely fasten each switch, circuit breaker and combination starter to the supporting structure or wall, utilizing a minimum of four (4) 1/4 inch bolts.

D. Maintain minimum clearances and workspace at equipment according to manufacturer’s written instructions and NEC. Do not mount in an inaccessible location or where the passageway to the switch may become obstructed.

E. Install fuses in fusible devices in accordance with Section 262813, “Fuses”.

F. Select and set overloads on the basis of full-load current rating as shown on motor nameplate.

G. Verify that overcurrent and overload protection devices are properly matched to actual motor nameplate data and service class.

H. Provide conductor reducers, taps and splices, as required, for proper termination of all branch circuits and feeders at disconnect switches, panelboards, motor starters, VFDs, etc. This shall include where conductors have been oversized to accommodate voltage drop, motor circuit conductor protection, and all instances where conductors are unable to terminate at factory lugs.

I. Final 18 inch of power wiring to motor shall be in liquid tight flexible conduit.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B. Where a tightening torque is indicated as a numeric value on equipment or in installation instructions provided by the manufacturer, use a calibrated torque tool to achieve that indicated torque value, unless the equipment manufacturer has provided installation instructions for an alternative method of achieving the required torque.

3.5 IDENTIFICATION

A. Comply with requirements in Section 260553, “Identification for Electrical Systems”

1. Identify field-installed conductors, interconnecting wiring, and components.
2. Provide Warning Signs.

3. Label each enclosure with nameplate.

3.6 FIELD QUALITY CONTROL:

A. Perform Test and Inspections:

1. Visual and Mechanical Inspection:

a. Compare equipment nameplate data with drawings and specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, and grounding.
d. Verify the unit is clean.
e. Inspect contactors:
1) Verify mechanical operation.
2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
f. Motor Protection:
1) Verify overload element rating is correct for its application.
2) If motor-running protection is provided by fuses, verify correct fuse rating.
g. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench or low resistance ohmmeter. Bolt-torque levels and/or bolted connection resistance values shall be according to manufacturer's published data.
h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.

2. Electrical Tests:
a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data.
b. Test motor protection devices according to manufacturer's published data.
c. Verify voltages at the controller locations are within plus or minus 10 percent of the motor nameplate rated voltages. If outside the range for any motor, notify the design team before starting the motor.
d. Perform operational tests by initiating control devices.
e. Test all auxiliary devices/system interfaces and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

B. Motor controller will be considered defective if it does not pass tests and inspections.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance, otherwise replace with new units and retest.

D. Prepare test and inspection reports, including a certified report that identifies motor controllers included and that describes results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF MOTOR CONTROLLERS

SECTION 26 43 00 - SURGE PROTECTION DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: The Contractor shall provide the necessary labor, materials, wiring and services necessary to provide the complete electrical surge protection systems as specified herein. This work shall include but is not necessarily limited to provision of Surge Suppression Units at certain points in the power distribution network and proper installation in accordance with manufacturer’s instructions.

B. Section includes:

1. Requirements for both field-mounted SPDs (externally mounted), and integrated SPDs (installed from the factory) for low voltage power distribution and control equipment.

1.3 REFERENCES

A. Abbreviations

1. MCOV: Maximum continuous operating voltage.
2. OCPD: Overcurrent protective device.
3. SCCR: Short-circuit current rating.
4. SPD: Surge protective device.
5. VPR: Voltage protection rating.

B. Definitions

1. Inominal: Nominal discharge current.
2. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
3. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
4. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.
5. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.
6. Type 3 SPDs: Point of utilization SPDs.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    a. ANSI/IEEE C62.41.1, “Guide on the Surges Environment in Low Voltage (1000 V and Less) AC Power Circuits.”
    b. ANSI/IEEE C62.41.2, “Recommended Practice on Characterization of Surges in Low Voltage (1000 V and Less) AC Power Circuits.”
    c. ANSI/IEEE Standard C62.45, “Guide on Surge Testing for Equipment Connected to Low-Voltage Ac Power Circuits”
2. Underwriters Laboratories, Inc. (UL)
    a. UL 1283, “Standard for Safety for Electromagnetic Interference Filters.”
    b. UL 1449, “Standard for Surge Protective Devices.”

1.4 SUBMITTALS

A. Product Data: For each type of product.
    1. Indicate all capacity ratings, clamp times, maximum capacities, physical characteristics, and listing agency approvals.
    2. Copy of UL certification, as a minimum, listing the tested values for VPRs, Inominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.
    3. Wiring diagram showing all manufacturer installed wiring including wire size, type, routing, and exact length of conductors.

B. Product Schedule: Indicate where each type of SPD is installed.

C. Closeout Submittal
    1. Operation and Maintenance Data: For surge protection devices and components to include in emergency, operation, and maintenance manuals.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within a period of ten years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    1. ABB/General Electric Company.
    2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
    3. Siemens.
    4. Square D; a brand of Schneider Electric.

B. Source Limitations: SPDs installed internal to the distribution system shall be of the same manufacturer as the equipment. The equipment shall be fully tested and certified in accordance with UL standards.

2.2 GENERAL SPD REQUIREMENTS

A. SPD with Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

B. SPDs: Comply with UL 1449

1. Provide Type 1 SPDs installed on the line side of the service entrance OCPD and Type 2 SPDs installed on the load side of the service entrance OCPD.

C. Electrical Noise Filter: Comply with UL 1283 for Type 2 SPDs.

1. Each Type 2 unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 50 dB from 10 kHz to 100 MHz

D. Unit Operating Voltage: Refer to drawings.

E. MCOV of the SPD shall not be less than 115% of the nominal system voltage.

F. The suppression system shall incorporate thermally protected MOVs as the core surge suppression component for all distribution levels. Each MOV shall be individually fuse-protected to avoid cascading faults. The thermal protection assembly shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur, that would cause them to enter a thermal runaway condition.

G. SPDs shall be provided with the following features and accessories:

1. Integral disconnect switch for externally mounted SPDs. SPDs integrated into factory supplied equipment shall have an input disconnect switch or circuit breaker unless indicated on the equipment drawings/data sheets.
2. Internal fusing that disconnects the SPD before damaging internal suppressor components.
3. Indicator light display (Red and Green) for power and protection status with push-to-test capabilities.
4. Audible alarm with silencing switch. Alarm shall activate when any one of the surge current modules has faulted or reached an end-of-life condition.
5. Form-C contacts, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
6. Surge counter with LCD display, reset switch, non-volatile memory, and battery backup to retain memory upon loss of AC power.

H. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

I. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than the following values. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.

1. Category C, Service Entrance larger than 1200A: 400 kA/phase.
2. Category C, Service Entrance 1200A and below: 240 kA/phase.
3. Category B, Distribution larger than 1200A: 300 kA/phase.
4. Category B, Distribution 1200A and below: 160 kA/phase.
5. Category B, Branch: 120kA/phase.

J. Protection modes and UL 1449 VPR for grounded wye circuits shall not exceed the following:

1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
3. Neutral to Ground: 1200 V for 480Y/277V and 700 V for 208Y/120 V.
4. Line to Line: 2000 V for 480Y/277 V and 1200 V for 208Y/120 V.

K. SCCR: The short circuit current rating of the SPD shall be a minimum of 200kA and equal to or greater than the available short circuit current at the point on the system where installed.

L. Minimum Inominal Rating: 20 kA

2.3 SURGE SUPPRESSORS FOR OTHER SYSTEMS

A. Refer to specific specification sections for additional information on surge suppressors related to other building systems.

2.4 ENCLOSURES

A. Enclosure shall meet or exceed the ratings for the environment to be installed as indicated on drawings.
1. Indoor locations: NEMA 250, Type 1.
2. Outdoor or wet locations: NEMA 250, Type 3R.
3. Corrosive Environments: NEMA 250, Type 4X.

2.5 CONDUCTORS AND CABLES

A. Power Wiring: Provide sizes to match SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1.

B. Factory install integral SPDs as part of the distribution equipment and connect through a disconnect.

1. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

C. Install external SPDs as indicated and in accordance with equipment manufacturer's written instructions, in compliance with applicable requirements of NFPA, local prevailing codes and with UL lightning and power surge protection standards to ensure that surge suppression systems comply with requirements.

1. Comply with manufacturer’s guidelines for physical routing, length limitations, and connections of conductors to ensure proper performance of surge suppression units.

D. Provide a minimum 30A circuit breaker as required to comply with the UL listing of the SPD.

E. Install SPDs with properly rated conductors between suppressor and points of attachment as short and straight as possible with no sharp bends and adjust circuit-breaker positions to achieve shortest and straightest leads.

F. Do not splice and extend SPD leads unless specifically permitted by manufacturer.

G. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.

H. Twist input conductors together to reduce the input inductance.

I. Use crimped connectors and splices only. Wire nuts are not acceptable.

3.2 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Compare equipment nameplate data for compliance with Drawings and Specifications.
2. Inspect anchorage, alignment, grounding, and clearances.
3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.

B. An SPD will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Complete startup checks according to manufacturer's written instructions.

B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests and reconnect them immediately after the testing is over.

C. Energize SPDs after power system has been energized, stabilized, and tested.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to operate and maintain SPDs.

END OF SURGE PROTECTION DEVICES

SECTION 26 50 00 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. This section is intended to specify in conjunction with the Light Fixture Schedule, the luminaires, supports, accessories, specialties, and related items necessary to complete the work as shown on the drawings.

B. Section Includes:
1. Interior light fixture
2. Exterior light fixtures including building mounted
3. Exit signs
4. Emergency lighting units
5. LEDs and drivers
6. Light fixture supports and accessories
7. Light fixture poles and bases

1.3 COORDINATION

A. This work consists of providing all labor, materials, accessories, mounting hardware and equipment necessary for an operationally and aesthetically complete installation of all luminaires, including power wiring, control wiring and accessories, in accordance with the contract documents.

B. Contractor shall provide all luminaires, as herein specified, complete with lamps, drivers, power supplies, ballasts, and accessories for safe and effective operation. All fixtures shall be installed and left in an operable condition with no broken, damaged, or soiled parts.

C. Contractor shall coordinate all infrastructure requirements with all approved lighting equipment prior to infrastructure installation, including, but not limited to appropriately sized, positioned and located junction boxes, structural supports, feeds, power and control conduits, and remote code-compliant power-supply enclosures.

D. All available finishes and colors, for each luminaire, shall be submitted to the Architect for selection during shop drawing review. Premium finishes, where indicated, shall be provided at no additional cost premium.

E. Specifications and drawings are intended to convey all salient features, functions, and characteristics of the luminaires only, and do not undertake to illustrate or set forth every item or detail necessary for the work. Minor details, not usually indicated on the drawings nor specified,

but that are necessary for proper execution and completion of the luminaries, shall be included, the same as if they were herein specified or indicated on the drawings.

F. The Owner, Architect and Engineer shall not be held responsible for the omission or absence of any detail, construction feature, etc. which may be required in the production of the light fixtures. The responsibility of accurately fabricating the light fixtures to the fulfillment of the specification rests with the Contractor.

G. Refer to architectural details, as applicable, for recessed soffit fixtures or wherever fixture installations depend upon work of other trades. Coordinate all installations with other trades. Verify dimensions of spaces for fixtures, and if necessary, adjust lengths to assure proper fit and illumination of diffuser and/or area below.

H. In accordance with the above and the criteria established herein, the Contractor is responsible for assuring the final design, fabrication and installation which fulfills the requirements of the Contract Documents.

1.4 REFERENCES

A. Abbreviations and Acronyms

1. CCT: Correlated color temperature
2. CRI: Color-rendering index
3. CU: Coefficient of utilization
4. IECC: International Energy Conservation Code
5. LER: Luminaire efficacy rating, which is calculated according to NEMA LE 5.
6. NRTL: Nationally Recognized Testing Laboratory
7. SPD: Surge Protective Device
8. RCR: Room cavity ratio.
9. UL: Underwriters Laboratory

B. Definitions

1. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, shall be as defined in the IESNA Lighting Library.
2. Light Fixture (Luminaire): Complete lighting unit consisting of a lamp(s) and driver(s)/ballast(s) (when applicable) together with the parts designed to distribute the light, to position and protect the lamp(s), and to connect the lamps to the power supply.
3. Lumen: Delivered output of luminaire.
4. Total harmonic distortion (THD): The root mean square (RMS) of all the harmonic components divided by the total fundamental current.
5. Pole: Luminaire support structure, including tower used for large area illumination.
6. Standard: Same definition as "Pole" above.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version (including amendments, addenda, revisions, supplements, and errata) as of the date of the Contract Documents, unless otherwise specified.

1. Illuminating Engineering Society of North America (IESNA)
   a. IES LS-1-20, Lighting Science: Nomenclature and Definitions for Illuminating Engineering
2. National Electrical Manufacturer’s Association (NEMA)
   a. NEMA SSL 1, Electronic Drivers for LED Devices, Arrays or Systems
   b. NEMA SSL 3, High-Power White LED Binning for General Illumination

1.5 SUBMITTALS

A. Product Data: For each type and model of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of lighting fixture including dimensions.
2. Emergency lighting units including battery and charger.
3. All available finishes and colors for each luminaire type shall be submitted to the Architect for selection during review.
4. Life, output (lumens, CCT, and CRI), and energy-efficiency data for light fixtures.
5. Dimensions, effective projected area (EPA), accessories, installation details and construction details.
6. Poles: Include dimensions, materials, wind load determined in accordance with AASHTO, pole deflection, pole class, and other applicable information.
7. Distribution data according to IESNA classification type as defined in IESNA handbook.
8. Anchor bolts.
9. US DOE LED Lighting Facts Label and IESNA L70 rated life.
10. Amount of shielding on luminaires.
11. Control type: 0-10V, DMX, bi-level, etc.

B. Shop Drawings: Including plans, elevations, sections, details, and attachment to other work.

1. Include detailed equipment assemblies and indicate electrical ratings, dimensions, emergency section, control type, wiring, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

C. Pole and Support Component Certification Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations by a professional engineer.

D. Sample Warranty

E. Closeout Submittals

1. Maintenance Contract
2. Operation and Maintenance Data
3. Warranty Documentation
4. Record Documentation
5. Sustainable Design Closeout Documentation
6. Software

1.6 MAINTENANCE MATERIAL

A. Furnish the following extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing content:

1. Single Sided Exit Sign: One for every 15 of each type. Furnish at least two of each type.
2. Double Sided Exit Sign: One for every 15 of each type. Furnish at least one of each type.
3. LED Drivers: One for every 50 of each type and rating installed. Furnish at least 5 of each type.
4. LED Lamps/Boards: One for every 100 of each type and rating installed. Furnish at least two of each type.

5. Emergency battery pack: One for every 50 units. Furnish at least one of each type.

1.7 QUALITY ASSURANCE

A. In each of the publications referred to herein, consider the advisory provisions to be mandatory.

B. Manufacturer Qualifications: Equipment shall be supported by service organizations which are reasonably convenient (less than 100 miles from project site) to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

C. Where groups of luminaire types exhibit the same list of acceptable Manufacturers, such as downlights, accents, and wall washers, the intent is to have a final installation with the same Manufacturer's equipment across the groupings as specified for consistency of optics, aesthetics, and similarity of maintenance procedures. Mixing/matching across groups is unacceptable. This also applies to multi-phased projects with single or multiple, but related luminaire types exhibiting the same list of acceptable Manufacturers, except where products have subsequently been discontinued or significantly redesigned in size, appearance, lamping, or gear. Lamps shall be from a single manufacturer and batch.

1.8 DELIVERY, STORAGE AND HANDLING:

A. The Contractor shall provide, receive, unload, uncrate, store, protect and install lamps, luminaires, and auxiliary equipment, as specified herein, in accordance with respective manufacturers' project conditions of temperature and humidity and with appropriate protection against dust and dirt. Lamps for miscellaneous equipment shall be provided and installed by the Contractor according to equipment manufacturers' guidelines.

B. All products shall be stored in manufacturer's unopened packaging until ready for installation.

C. Luminaire Poles: Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Support poles to prevent distortion and arrange to provide free air circulation. Retain factory-applied pole wrappings on poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.9 COORDINATION

A. Coordinate layout and installation of exterior lighting fixtures with all other construction including all underground utilities and geothermal well fields.

B. Coordinate layout and installation of lighting fixtures with all other construction that penetrates ceilings or is supported by them, including HVAC equipment, plumbing, fire-suppression system, and partition assemblies.

C. Contractor shall coordinate all infrastructure requirements with all approved lighting equipment prior to infrastructure installation, including, but not limited to appropriately sized, positioned and located junction boxes, structural supports, feeds, power and control conduits, and remote code-compliant power-supply enclosures.

D. Prior to procurement of light fixtures:
1. Confirm application and required voltage.

2. Confirm the proper and complete catalog number with distributor and agent.
3. Ensure wiring, driver, etc. meets the specifications and proper requirements.
4. Provide additional parts and pieces required to complete the installation in the location and manner intended by the design.

E. Light fixture locations in mechanical and electrical equipment rooms/areas are approximate. Locate light fixtures to avoid equipment, ductwork, and piping. Locate around and between equipment to maximize the available light. Coordinate mounting heights and locations of light fixtures to clear equipment. Request a meeting with the Engineer if uncertain about an installation.

F. Coordinate between the electrical and ceiling trades to ascertain that approved luminaires are furnished in the proper sizes, with the proper flange details, and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

1.10 WARRANTIES

A. Manufacturer Warranty: All luminaries, finishes, poles, batteries, supports, accessories and all of its component parts, workmanship, and controls shall have an unconditional five (5) year on-site replacement warranty. Warranty shall include all light fixtures, lamps, drivers, poles, finishes and all components to be free from defects in materials and workmanship for a period of five (5) years from date of Owner's acceptance. On-site replacement includes transportation, removal, and installation of new products. Replacement of luminaries, faulty materials, and the cost of labor to make the replacement shall be the responsibility of the Contractor.
1. Luminaires: Five (5) years from date of substantial completion.
2. LED drivers: Ten (10) years from the date of substantial completion. The warranty shall state the malfunctioning LED driver shall be exchanged by the manufacturer and promptly installed by the Contractor. The replacement LED driver shall be identical to, or an improvement upon, the original design of the malfunctioning LED driver.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

B. Comply with NFPA 70.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide one of the products indicated on Light Fixture Schedule. Refer to Light Fixture Schedule for manufacturers and model numbers. Basis of Design for each light fixture type shall be the first fixture manufacturer and model number for each type listed.

B. Manufacturer's catalog numbers together with the descriptions on the drawings and these specifications are indicative of required design, appearance, quality, and performance. Report any discrepancies between any of these to the Engineer for resolution prior to bid. In absence of

such notice to the Engineer, provide the greater requirement as directed by the Engineer, without additional cost.

C. All luminaires shall be DLC (Design Lights Consortium) or Energy Star Certified.

2.3 EQUAL MANUFACTURERS

A. Manufacturers listed as “Equal” to the Basis of Design on the light fixture schedule shall submit product cutsheets to the Engineer prior to bid for final written approval. This written approval will only be issued in addendum form. “Equal” fixtures shall be of equal or better quality and performance to the fixture(s) listed with manufacturer’s model numbers. Burden of proof shall be on the Contractor, Vendor, and manufacturer.

B. Upon request by Engineer, the Contractor shall submit manufacturer’s computerized horizontal illumination levels using AGI32 software in footcandles at workplane (30" above finished floor), taken every 3 feet in every interior room and area. Include average maintained footcandle levels and maximum and minimum ratio.

C. Upon request by Engineer, the Contractor shall submit manufacturer’s computerized horizontal illumination levels using AGI32 software in footcandles, taken every ten (10) feet at grade for the entire exterior site. Include average maintained footcandle levels and maximum and minimum ratio.

D. Refer to specification Section 260010 “General Requirements for Electrical Systems” for additional requirements.

2.4 GENERAL REQUIREMENTS FOR LUMINAIRES AND COMPONENTS

A. Complete luminaires shall be in accordance with NFPA 70, NEMA, and UL 1598 listed and labeled.

B. Ballasts, drivers, or transformers, unless otherwise specified, shall be field replaceable and shall be serviceable while the fixture is in its normally installed position, and shall not be mounted to removable reflectors or wireway covers unless so specified.

C. Luminaires shall be entirely factory wired by the luminaire manufacturer in accordance with code and UL requirements and shall be furnished fully compatible with the project electrical wiring and controls system for smooth, continuous, dimming or on/off flicker-free operation.

D. Exterior building mounted light fixtures shall be UL classified for damp or wet locations as applicable and shall be complete with gaskets, cast aluminum outlet box and grounding. Luminaires shall be suitably gasketed and vented according to manufacturer’s instructions. All dissimilar metal materials shall be separated by non-conductive materials to prevent galvanic action.

E. All luminaires supplied for recessing in suspended ceilings shall be supplied with pre-wired junction boxes, unless otherwise specified.

F. Metal parts: Free of burrs, sharp corners, and sharp edges.

G. Doors, frames, and other internal access: Smooth operating, free of light leakage under operating conditions. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidently during maintenance and when secured during operating position.

H. Mounting Frames and Rings: If ceiling system and luminaire type requires, each recessed and semi-recessed luminaire shall be furnished with a mounting frame or ring compatible with the ceiling in which they are to be installed as coordinated by Contractor. The frames and rings shall be one piece and of sufficient size and strength to sustain the weight of the luminaire and maintain plumb. Luminaires shall be braced such that the force required to close and/or latch lens or door frame does not lift or shift luminaire.

I. Pendant Supports: Contractor shall be responsible for coordination with Manufacturer, Architect, Structural Engineer, and related trades to ensure that proper and adequate structural reinforcement is provided within ceilings to support pendant mounted lighting equipment for a secure, neat, square, plumb appearance. Pendants shall not sag, droop, snake or otherwise appear out of plumb or alignment in finished installation with lamps, globes, lenses, lens frames or doors etc. in place.

J. Wall Bracket (Sconce) Supports: Contractor shall be responsible for coordination with Manufacturer, Architect, Structural Engineer, and related trades to ensure that proper and adequate structural reinforcement is provided within walls to support wall mounted lighting equipment for a secure, neat, square, plumb appearance. Wall brackets shall not sag, droop, snake or otherwise appear out of plumb or alignment in finished installation with lamps, globes, lenses, lens frames or doors etc. in place.

K. All lenses or other light diffusing elements shall be removable for access to lamp and electrical and electronic components and luminaire cleaning, however, they must otherwise be positively and securely held in-place, unless otherwise specified.

L. All lens door or holder trim flanges shall fit plumb and flush with the ceiling or wall surface. There shall be no light leaks around the interface between lens door or holder trim flanges and the ceiling or wall.

M. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility.

N. Recessed luminaires mounted in an insulated ceiling shall be listed for use in insulated ceilings, IC-rated, or provisions made to maintain code-compliant 3” air-space around luminaires in accordance with Manufacturers' instructions.

O. Mechanical Safety: Unless otherwise specified, luminaire closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

P. Unless otherwise specified, luminaires with louvers or light transmitting panels shall have hinges, latches, and safety catches to facilitate safe, convenient cleaning and re-lamping. Vapor tight luminaires shall have stainless steel pressure clamping devices.

Q. Yokes, brackets, and supplementary supporting members necessary for mounting lighting equipment shall be furnished and installed by the Contractor and approved by the Architect. All materials, accessories, and any other equipment necessary for the complete and proper installation of luminaires, lamps, ballasts/neon transformers included in the contract shall be furnished and installed by the Contractor. All yokes, brackets and supplementary supports shall provide a neat, square, plumb, and level appearance, and shall not sag, droop, snake or

otherwise appear out of plumb or alignment in finished installation with all lamps, globes, lenses, lens frames or doors etc. in place.

R. All connections shall be fixed rigid by screws, rivets and/or soldering. Screws and rivets shall not be visible except as necessary for maintenance and/or aesthetic appearance. All connections shall provide a neat, square, plumb, and level appearance, and shall not sag, droop, snake or otherwise appear out of plumb or alignment in finished installation with lamps, globes, lenses, lens frames or doors etc. in place.

S. All housings shall be free from tool marks and dents and shall have accurate angles bent as sharp as compatible with the gauges of the required metal and the luminaire styling. All intersections and joints shall be formed true and of adequate strength and structural rigidity to prevent any distortion after assembly.

T. For steel and aluminum luminaires, all screws, bolts, nuts and other fastening and latching hardware shall be a cadmium or equivalent plated. For stainless steel luminaires, all hardware shall be stainless steel. For all bronze luminaires, all hardware shall be bronze.

U. Extruded aluminum frames and trims shall be rigid and manufactured from quality aluminum without blemishes in the installed product. Miter cuts shall be accurate; joints shall be flush and without burrs and cut alignment maintained with the luminaire located in its final position.

V. Castings shall exactly replicate the approved pattern(s) and shall be free of sand pits, blemishes, scales, and rust and shall be smoothly finished, excepted as necessary for an authentic historic appearance, and as agreed by Architect. Tolerances shall be provided for any shrinkage in order that the finished castings accurately fit their locations resulting in plumb and level fit and consistently tight-seamed fittings.

W. Luminaires in Hazardous Areas: Luminaires shall be suitable for installation in flammable atmospheres (Class and Group) as defined in NFPA 70 and shall comply with UL 844.

X. Each light fixture shall be packaged with complete instructions and illustrations on how to install.

Y. Each light fixture box, container, etc shall be labeled at the factory with the type designation as indicated on the Light Fixture Schedule.

Z. Provide factory cut custom stem lengths, as required.

AA. Exit signs and fixtures that are hatched or where the fixture type contains the suffix "E" for emergency operation, the fixture shall have an integral 90-minute battery inverter if not powered from an emergency generator.

BB. All battery powered fixtures shall have test switches factory installed integral to the reflector. Remote test switches will not be accepted.

2.5 LUMINAIRE REFLECTORS AND TRIMS

A. Alzak cones, reflectors, baffles, and louvers shall be warranted against discoloration.

B. All trims, reflectors and canopies shall fit snugly and securely to the ceiling or wall so that no light leak occurs.

C. Trims shall be self-flanged, unless otherwise specified.

D. For trimless or flangeless luminaires, Contractor shall coordinate with other Trades to achieve a trimless/flangeless installation acceptable to the Architect. Where ceilings are drywall or plaster, this involves Level 5 finishes or as otherwise directed by the Architect. In drywall, plaster, wood, or stone ceilings, special luminaire collars and exacting coordination are required of Contractor.

2.6 LIGHT EMITTING DIODE (LED) ELECTRONIC DRIVERS

A. The electronic drivers shall as a minimum meet the following characteristics:
1. LED drivers shall comply with NEMA SSL 1, NFPA 70, and UL 8750 unless otherwise specified.
2. Drivers remote from luminaires shall be housed in NEMA enclosures so rated for the driver and located in code-compliant, sound-isolated, well-ventilated, and easily accessible areas. Wire shall be sized according to run length and LED Manufacturer's size and distance-of-run requirements and all in accordance with all code requirements.
3. Driver shall comply with UL 1310 Class 2 requirements for dry and damp locations, NFPA 70 unless specified otherwise. Drives shall be designed for the wattage of the LEDs used in the indicated application. Drivers shall be designed to operate on the voltage system to which they are connected.
4. LED driver shall withstand up to a 1,000-volt surge without impairment of performance as defined by ANSI C62.41 Category A.
5. LED driver shall tolerate ±10 percent supply voltage fluctuation with no adverse effects to driver or LEDs.
6. Drivers for luminaires controlled by dimming devices shall be as specified herein and equipped for dimming and conform to the recommendations of the manufacturer of the associated dimming devices to assure satisfactory operation of the lighting system. Contractor shall coordinate all wiring infrastructure to accommodate final-selected drivers and controls systems for smooth, continuous, and flicker-free operation.
7. Flicker: The flicker shall be less than 5 percent at all frequencies below 1000 Hz and without visible flicker.
8. Provide with short circuit, open circuit, and overload protection.
9. Drivers shall meet or exceed NEMA 410 driver inrush standard.
10. Total Harmonic Distortion shall be less than 20 percent.
11. Power Factor to be greater than 95%
12. Drivers to be reduction of hazardous substances (ROHS) compliant

2.7 LIGHT EMITTING DIODE (LED)

A. The light emitting diodes shall as a minimum meet the following characteristic:

1. LED lamps shall comply with ANSI C78.1, IESNA LM-79 and IESNA LM-80.
2. Light emitting diodes shall be tested under IES LM-80 standards.
3. Color Rendering Index (CRI) shall be 84 (minimum).
4. Rated lumen maintenance of 90% lumen output at 50,000 hours (minimum).
5. Rated lumen maintenance of 70% lumen output at 100,000 hours (minimum).

2.8 SUSPENDED LUMINAIRES

A. Provide hangers capable of supporting twice the combined weight of fixtures supported by hangers. Provide with swivel hangers to ensure a plumb installation. Hangers shall be cadmium-plated steel with a swivel-ball tapped for the conduit size indicated. Hangers shall allow fixtures to swing within an angle of 45 degrees. Brace pendants 4 feet or longer to limit swinging. Single-unit suspended fixtures shall have twin-stem hangers. Multiple-unit or continuous row fixtures

shall have a tubing or stem for wiring at one point and a tubing or rod suspension provided for each unit length of chassis, including one at each end. Rods shall be a minimum 0.18 inch diameter.

B. All suspended luminaires with a weight in excess of 50 pounds shall be fitted with safety cable of sufficient strength and length to meet all UL safety cable load-bearing requirements. Cable shall exhibit a finish (but not painted) compatible with that of the metal finish of the stem/chain/suspension-cable assembly or alternatively finished in black as approved by Architect. Shop drawings shall indicate luminaire weight. Contractor shall coordinate structural support/attachment requirements including independent structure for safety cable attachment with Vendor, Architect, and Structural Engineer and all respective trades. Safety cable shall exhibit sufficient length to wrap tightly and entirely around structural member at least twice before attachment subject to Vendor confirmation of UL requirements and pending Structural Engineer review. Contractor shall provide labor necessary for the stem/chain-assembly-wiring-threading and safety-cable-attachment as instructed by Vendor.

2.9 DOWNLIGHT FIXTURES AND COMPONENTS

A. Downlights shall be listed for thru-branch circuit wiring, recessing in ceilings and damp locations.

B. Where installed in plaster or drywall or other inaccessible ceiling types, they shall be UL listed for bottom access.

C. Provide with tool-less hinged junction box access cover and thermal protection accessible from below through reflector opening.

D. Provide telescoping channel bar hangers that adjust vertically and horizontally.

2.10 EXIT SIGNS

A. General requirements: Comply with UL 924, NFPA 70, AND NFPA 101.

B. All exit signs shall be LED type.

C. Provide single or double face as scheduled, indicated on plans, or as required by the local Authority Having Jurisdiction. Adjust installation position if required for clear visibility, in accordance with applicable codes.

D. Provide directional arrows (chevrons) as indicated on floor plans and to suit the means of egress or as required by the local Authority Having Jurisdiction.

E. Where emergency backup battery packs are provided with exit lights, they shall have capacities for continuous operation per applicable codes. All exit signs with battery backup shall be provided with self-diagnostics.

F. Complete unit to be furnished in color/finish as selected by the Architect.

2.11 EMERGENCY DRIVER

A. Description: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with driver. Complying with UL924.

1. Provide a minimum of 90 minutes of battery back-up upon loss of power.
2. Constant Power Output: minimum 10W, uon.
3. Battery: High temperature Nickel Cadmium or Lithium Iron Phosphate, uon.
4. Charger: Fully automatic, solid-state type with sealed transfer relay.
5. Operation: Solid state switching circuit automatically turns light fixture on upon absence of power-supply circuit voltage and switches back to normal operation upon restoration of AC power.
6. Test Push-Button and Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.
   a. Push-Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   b. Indicator Light: LED indicates normal power on and charger operation.
7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.12 EMERGENCY INVERTER

A. Description: Stand alone, modular, modified sine wave output battery-inverter unit, remote mounted from luminaire. Complying with UL924.
   1. Provide a minimum of 90 minutes of battery back-up upon loss of power.
   2. Power Output: suitable for powering designated emergency light fixtures.
   3. Battery: Sealed, maintenance-free, nickel-cadmium or lead-acid type.
   4. Charger: Fully automatic, solid-state, constant-current type.
   5. Operation: Solid state switching circuit automatically turns connected fixtures on upon absence of power-supply circuit voltage and switches back to normal operation upon restoration of AC power.
   6. Steel Housing: Type 1 enclosure listed for installation inside, on top of, or remote from luminaire.
   7. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.13 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.
   1. Provide a minimum of 90 minutes of battery back-up.
   2. Battery: Sealed, maintenance-free, lead-acid type, UON.
   3. Charger: Fully automatic, solid-state type with sealed transfer relay.
   4. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
   5. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
   6. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
   7. Wire Guard: Heavy-chrome-plated wire guard protects lamp heads or fixtures. Install wire guards in gymnasiums.

8. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.14 LUMINAIRE SUPPORT HANGERS AND COMPONENTS

A. Wires: ASTM A641/A641M, Class 3, soft temper, galvanized regular coating, 0.1055 inches in diameter (12 gage).

B. Straps: Galvanized steel, one by 3/16 inch, conforming to ASTM A653/A653M, with a light commercial zinc coating or ASTM A1008/A1008M with an electrodeposited zinc coating conforming to ASTM B633, Type RS.

C. Rod Hangers: Threaded steel rods, 3/16 inch diameter, zinc or cadmium coated.

2.15 GENERAL REQUIREMENTS FOR POLES AND SUPPORT COMPONENTS

A. Provide poles designed for site specific wind loading (minimum of 120 miles per hour) determined in accordance with AASHTO LTS while supporting luminaires and all other appurtenances indicated. The effective projected areas of luminaires and appurtenances used in calculations shall be specific for the actual products provided on each pole. Poles shall be anchor-base type designed for use with underground supply conductors. Poles shall have full base metal covers with matching finish to conceal the mounting hardware, pole-base welds, and anchor bolts.

B. Structural Characteristics: Comply with AASHTO LTS
1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in "Structural Analysis Criteria for Pole Selection" Article.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.3 to obtain the equivalent projected area to be used in pole selection strength analysis.

C. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners, unless otherwise indicated.

D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication unless otherwise indicated.
3. Anchor-Bolt Template: Plywood or steel.

E. Handhole: Oval-shaped, with minimum clear opening of 2-1/2 by 5 inches, with cover secured by stainless-steel captive screws.

F. Pole Base Concrete Foundations:
1. Cast in place, with anchor bolts to match pole-base flange. Anchor bolts shall be steel rod having minimum yield strength of 50,000 psi and shall be galvanized in accordance with ASTM A153/A153M. Concrete shall be as specified in Division 03 Section, Cast-In-Place Concrete.

2. Use 4000-psi, 28-day compressive-strength concrete unless otherwise noted. Comply with Division 03 Section "Cast-in-Place Concrete" and ACI standards for subbase requirements, concrete materials, reinforcement, placement, and cover requirements.

G. Breakaway Supports: Provide frangible breakaway supports where noted on plans, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS.

H. Brackets and Supports
1. ANSI C136.3, ANSI C136.13, and ANSI C136.21, as applicable. Pole brackets shall be not less than 1-1/4 inch secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets shall be coordinated to luminaires provided, and brackets for use with one type of luminaire shall be identical. Brackets for pole-mounted street lights shall correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Special mountings or brackets shall be as indicated and shall be of metal which will not promote galvanic reaction with luminaire head. Detachable, cantilever, without underbrace.

I. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.

J. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole. Provide a pole grounding connection designed to prevent electrolysis when used with copper ground wire.

K. Finish: Same as luminaire.

2.16 FUSING

A. All luminaires shall be provided with fuse(s) and in-line fuse holder(s) sized per manufacturer’s recommendation.

B. Fuse pole mounted luminaires at handhole.

2.17 POLE ACCESSORIES

A. Duplex Receptacle: Where indicated on plans, provide 120 V, 20 A receptacle in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for a weather resistant, ground-fault circuit-interrupter type. Recessed, 12 inches above pole base. Weatherproof, metal, in-use cover, color to match pole, that when mounted results in NEMA 250, Type 4X enclosure with cord opening and lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

1. Minimum 1800-W transformer, protected by replaceable fuses, mounted behind access cover for poles supplied by voltage other than 120 V.

B. Base Covers: Provide Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

2.18 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

A. Comply with UL 773 or UL 773A.

B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.

1. Relay with locking-type receptacle shall comply with ANSI C136.10.
2. Adjustable window slide for adjusting on-off set points.

2.19 FACTORY APPLIED FINISH

A. Electrical equipment shall have factory-applied painting systems which shall, as a minimum, meet the requirements of NEMA 250 corrosion-resistance test.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Architect’s reflected ceiling plan (RCP) indicates actual locations of all light fixtures, diffusers, and system devices. Report to the Architect/Engineer any conflicts. Do not scale plans for exact location of lighting fixtures.

B. Coordinate mounting for lighting fixtures on the job before commencing installation and, where applicable, after coordinating with the type, style, and pattern of the ceiling being installed.

C. Install luminaires in accordance with luminaire manufacturer’s written instructions, applicable requirements of NEC, NECA, and NEMA standards.

D. Installed luminaires shall be provided with protective covering by Contractor until such time as the space(s) is cleaned and ready for occupancy.

E. Set luminaires plumb, square, and level with ceiling and walls, in alignment with adjacent lighting fixtures, and secured in accordance with manufacturers' directions and approved drawings.

F. Lighting Fixture Supports:

1. Comply with Section 260500, Common Work Results for Electrical Systems.

2. Sized and rated for luminaire weight.
3. Shall maintain the fixture positions after cleaning and re-lamping.
4. Ensure that the luminaires are supported such that there is no resultant bowing or deflection of the ceiling or wall system.
5. Capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

G. Recessed, semi-recessed and surface fixtures shall be independently supported from the buildings structure. Do not support any luminaire solely from ceiling grid or ceiling. Ceiling grid clips are not allowed as an alternative to independently supported light fixtures.

H. Ceiling Grid mounted light fixtures:

1. Lighting fixtures installed in suspended ceilings shall also comply with the requirements of Division 09 Specification Sections for ceilings.
2. Support fixtures with four (4) wires with one (1) at each corner.
3. Hanger wires: Install within 15 degrees of plumb or additional support shall be provided. Wires shall be attached to fixture body and to the building structure (not to the supports of other work or equipment). Where building structure is located such that 15 degrees cannot be maintained, provide “strut” or similar supports secured to structure to meet this requirement.
4. Support Clips: Provide four (4) clips per fixture minimum. Fasten to light fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application. Install clips per manufacturer’s requirements. If screws are required, they shall be provided. Installation shall meet applicable seismic codes.
5. Where fixtures of sizes less than the ceiling grid are indicated to be centered in the acoustical panel, support such fixtures independently and provide at least two 3/4-inch metal channels spanning, and secured to, the ceiling tees for centering and aligning the fixture.
6. Downlights, exit signs and battery pack supported by or attached to ceiling grid or tile shall be provided with one hanger wire at each end. Provide a minimum of two, located at opposite corners.
7. Round fixtures or fixtures smaller in size than the ceiling grid shall be independently supported from the building structure by a minimum of four wires per fixture spaced approximately equidistant around the fixture. Do not support fixtures by ceiling acoustical panels.

I. Suspended fixtures:

1. Hang plumb and shall be located with no obstructions within the 45 degree range in all directions. The stem, cable, canopy and fixture shall be capable of 45 degree swing.
2. Suspended fixtures in continuous rows shall have internal wireway systems for end to end wiring and shall be properly aligned to provide a straight and continuous row without bends, gaps, light leaks or filler pieces. Aligning splines shall be used on extruded aluminum fixtures to assure hairline joints. Steel fixtures shall be supported to prevent "oil-canning" effects.
3. Pendants shall be finished to match fixtures. Aircraft cable shall be stainless steel.
4. Canopies shall be finished to match the ceiling and shall be low profile unless otherwise shown.
5. Whenever a luminaire or its hanger canopy is installed directly to a surface mounted junction box, a finishing ring painted to match the ceiling, shall be used to conceal the junction box.

J. Wall mounted fixtures:

1. Do not attach light fixtures directly to gypsum board.
2. Attach to structural members in walls or backing plate attached to wall structural members.

K. Rigidly align continuous rows of light fixtures for true in-line appearance.

L. Exit Signs and Emergency Lighting Units: Wire exit signs ahead of the switch to the un-switched branch circuit located in the same room or area. Connect to emergency system branch circuit where applicable.

M. Where emergency battery packs are provided with fixtures (if any), they shall be connected to an un-switched power line and wired in accordance with applicable codes and the manufacturer's recommendations.

N. Light fixture whips shall be independently supported from the building structure. Do not clip to lay-in ceiling support wires. Independent support wires shall be distinguishable by colors, tagging, or other effective means.

O. Exterior Fixtures:

1. Exterior building mounted light fixtures shall not be installed until after the building exterior has been rinsed clean of any corrosive cleaning materials. Damaged fixtures shall be replaced by the Contractor at no cost.
2. Provide exterior rated weather proof junction boxes for all fixtures and splices.
3. Utilize weatherproof silicone filled wire nuts and seal all junction boxes and conduit with potting compound to create waterproof barriers. Inspect all splices and fixtures for continuity prior to potting.
4. Lubricate all threaded parts with a high temperature waterproof anti-seize lubricant to prevent seizing and corrosion.
5. All low-voltage wiring to be UV resistant, UL approved for use without conduit, stranded low-voltage wire for use in outdoor and underground applications, gauge as appropriate to avoid voltage drop.
6. Provide surface mounted fixtures with conduit hub for end of fixture entrance.

P. Transformers (applies to all transformers including (but not limited to) low voltage, neon, remote ballast, LED power supplies, exterior locations):

1. Electrical Contractor to locate all transformers (including low voltage, neon, remote ballasts, led power supplies, etc.) near fixtures in a well-ventilated and accessible location. Transformers must be installed (per codes) in accessible areas large enough to dissipate the heat of the transformer. Temperatures should not exceed 100°F (38°C) or that required by manufacturer if more stringent.
2. Electrical Contractor to determine wire size according to load and wire length to eliminate voltage drop. If voltage drop is a problem after installation, the Electrical Contractor is responsible for reinstallation (at no additional cost) of transformer and wire to solve problem.
3. Electrical Contractor to label front of transformer/driver. Example: “Large Display Case @ Entry to Main Dining Room.”

Q. Seal all knock-outs, conduit, and wire entrances for all luminaires in wet and damp locations to prevent water wicking.

R. All reflecting surfaces, glass or plastic lenses, ballast housings, parabolic louvers, downlighting alzak cones and specular reflectors and other decorative elements shall be installed after completion of ceiling tile installation, plastering, painting and general cleanup.

S. Handle all reflecting surfaces, glass or plastic lenses, ballast housings, parabolic louvers, downlighting alzak cones and specular reflectors and other decorative elements with care during installation or lamping to avoid fingerprints or dirt deposits.

T. Luminaires installed and used for working light during construction shall be replaced prior to turnover to the Owner if more than 3 percent of their rated life has been used. Fixtures shall be tested for proper operation prior to turn-over and shall be replaced if necessary.

3.3 POLE, LIGHT COLUMN AND BOLLARD INSTALLATION

A. Alignment: Align foundations, poles light columns and bollards for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features unless otherwise indicated on Drawings:
1. Fire Hydrants and Storm Drainage Piping: 60 inches
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet
3. Trees: 15 feet from tree trunk.

C. Excavation: Restrict excavation in size to that which will provide sufficient working space for installation of concrete forms. Should soil conditions at the bottom of the excavation be unsuitable as a foundation, as determined by the Architect, take the excavation down to firm soil and fill to required grade with concrete or satisfactory soil materials as directed.

D. Backfill: Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell.

E. Concrete Pole Foundations:
1. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
2. Concrete Pole Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.
3. Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer.
4. Formwork: Construct forms of wood, plywood, steel, or other acceptable materials fabricated to conform to the configuration, line, and grade required. Reinforce formwork to prevent deformation while concrete is being placed and consolidated. Wet or coat formwork with a parting agent before placing concrete.
5. Cast conduit into concrete pole foundations.
6. Prior to concrete pour, install a ground rod and a separate insulated equipment grounding conductor at each pole, light column, and bollard in addition to grounding conductor installed with branch-circuit conductors.
7. Finish by troweling and rubbing smooth. Round all above-grade concrete edges to approximately 0.25” radius.
8. Refer to Pole Base Detail on drawings for additional requirements.

F. Foundation-Mounted Poles:
1. Install according to pole manufacturer's instructions using a template supplied by pole manufacturer in accordance with the lighting standard manufacturer's recommendations.
2. Use galvanized steel anchor bolts, threaded at the top end, and bent 90 degrees at the bottom end, and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
3. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
4. Mount pole with leveling nuts and tighten top nuts to torque level recommended by pole manufacturer. Provide base covers.

G. Poles and Pole Foundations Set in Concrete Paved Areas (Slabs): Install poles with minimum of 6-inch wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch below top of concrete slab.

H. Raise and set poles using web fabric slings (not chain or cable). Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location. Alterations to poles after fabrication will void manufacturer's warranty and shall not be allowed.

I. Bollard and light column luminaire installation:
   1. Install on concrete base with top level with finished grade or surface at luminaire location. Shape base to match shape and diameter of bollard and/or light column base.

3.4 GROUND-MOUNTING LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top 4 inches above finished grade or surface at luminaire location.

3.5 IN-GRADE LUMINAIRE INSTALLATION

A. All in-grade fixtures shall be installed per manufacturer’s installation instructions.

B. Verify design type, Flow Through or Sealed, prior to installation.

C. Flow Through in-grades fixtures shall have drainage system installed below fixture per manufacturer’s requirements. If site has poor drainage soil, a sealed in-grade shall be installed. Coordinate soil type with civil engineer prior to submittals.

D. Provide all conduit connections to in-grade fixture with seal off compound.

3.6 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

3.7 GROUNDING

A. Comply with Section 260xxx

B. Bond luminaires and metal accessories to the grounding system per NEC.

C. Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

D. At each light pole, light column, light bollard, and support structures, provide a driven ground rod into the earth so that after the installation is complete, the top of the ground rod will be approximately 1 foot below finished grade. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.8 IDENTIFICATION

A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Light fixtures served from multiple power sources, such as emergency fixtures fed from emergency transfer relay or split wired fixtures, shall have the following label affixed to it: “DANGER - ELECTRICAL SHOCK HAZARD - LIGHT FIXTURE HAS MULTIPLE POWER SOURCES”

B. Manufacturer's Nameplate: Each item of equipment shall have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

C. Factory-Applied Labels: Provide labeled luminaires in accordance with UL 1598 requirements. All light fixtures shall be clearly marked for operation of specific LED’s and drivers according to proper type. The following characteristics shall be noted in the format "Use Only _____":
1. LED or lamp type, and nominal wattage
2. Driver or ballast type
3. Correlated color temperature (CCT) and color rendering index (CRI)
4. All markings related to lamp type shall be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when lamps are in place. Drivers and ballasts shall have clear markings indicating multi-level outputs and indicate proper terminals for the various outputs.

3.9 FIELD QUALITY CONTROL:

A. The lighting and lighting controls systems shall be synchronized and fully operable to address the lighting operation in a complete and code-compliant manner.

B. Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Conduct an operating test to show that equipment operates in accordance with requirements of this section. Replace defective light fixtures, controls, lamps, ballasts, and drivers at no cost to Owner.

C. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal and emergency power sources.

D. Illumination Tests:
1. Measure light intensities at night. Use certified photometers with calibration referenced to NIST standards. Record footcandle results and furnish to the Engineer. Comply with the following IESNA testing guide(s):
a. IESNA LM-5, “Photometric Measurements of Area and Sports Lighting Installations.”
b. IESNA LM-50, “Photometric Measurements of Roadway Lighting Installations.”
c. IESNA LM-52, “Photometric Measurements of Roadway Sign Installations.”
d. IESNA LM-64, “Photometric Measurements of Parking Areas.”
e. IESNA LM-72, “Directional Positioning of Photometric Data.”

E. Dimming Drivers. Test for full range of dimming capability. Observe for visually detectable flicker over full dimming range. Replace defective light fixtures, controls, lamps, ballasts, and drivers at no cost to Owner.

F. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal. Replace defective light fixtures at no cost to Owner.

G. Inspect each light fixture for damage. Replace damaged light fixtures at no cost to the Owner.

H. Fixtures showing dirt, dust or fingerprints shall be restored to like new condition or shall be replaced at no cost.

3.10 CLEANING

A. At completion of each phase and the time of final acceptance by the Owner, all lighting fixtures shall have been thoroughly cleaned with materials and methods recommended by the manufacturer.

B. All fingerprints, dirt, tar, smudges, drywall mud and dust, etc. shall be removed by the Contractor from the luminaire bodies, reflectors, trims, and lens/louvers prior to final acceptance. Cleaned with solvent recommended by the manufacturer to a like-new condition or replaced. All reflectors shall be free of paint other than factory-applied, if any.

3.11 ADJUSTING

A. All adjustable luminaires shall be aimed, focused, locked, etc., by the Contractor under the observation of the Architect and Engineer. As aiming and adjusting is completed, locking setscrews and bolts and nuts shall be tightened securely by the Contractor. All aiming and adjusting shall be performed after the entire installation is complete for each phase or area. The Contractor shall be responsible for notifying the Architect of appropriate time for final luminaire adjustment. Where possible, units shall be focused during the normal working day. However, where daylight interferes with seeing lighting effects, aiming shall be accomplished at night at no premium cost.

B. All ladders, scaffolds, lifts, gloves, cleaning cloths, access/adjustment tools, etc. required for aiming and adjusting luminaires shall be furnished by the Contractor.

C. Occupancy Adjustments: When requested within 12 months of date of Completion, provide on-site assistance in adjusting aimable luminaires to suit actual occupied conditions. Provide up to two (2) visits to Project during other-than-normal occupancy hours for this purpose. Some of this work may be required after dark.
   1. Adjust aimable luminaires in the presence of Architect/Engineer.

END OF LIGHTING

SECTION 27 00 10 - SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Division 27 – Communications governs the structured cabling infrastructure for the low-voltage information transport systems, which can include but are not limited to voice, data, cable TV (CATV), audio/video, intercommunication systems, distributed antenna systems, and their pathways.

B. The installed structured cabling infrastructure should be able to support interconnections to active telecommunications equipment for IP telephony, desktop computers, IP surveillance cameras, and other technologies in a multi-vendor, multi-product environment. The structured cabling infrastructure shall adhere to applicable standards as listed below with respect to performance, pathways, distribution, administration, and grounding of the system. The structured cabling system shall be installed in accordance with local codes and regulations.

C. Contractor is solely responsible for all parts, labor, testing, documentation and all other processes and physical apparatus necessary to turn over the completed cabling system and associated infrastructure fully warranted and operational for acceptance by Owner.

D. This specification includes structured cabling design considerations, product specifications, and installation and testing requirements for low-voltage network systems and associated infrastructure including, but not limited to:

1. Horizontal Cabling and Terminations
2. Backbone Cabling and Terminations
3. Telecommunications Pathways
4. Communications Equipment Room Fittings
5. Communications Grounding and Bonding Systems
6. Cable Labeling and Administration

E. The following equipment is to be owner-furnished, owner-installed. This does not alleviate the contractor from fully coordinating with the owner to ensure compatibility of the contractor’s systems with the owner’s systems and equipment:

1. Telephones
2. Client Workstations, PCs, monitors, printers, faxes
3. Wireless Access Points
4. Network Switches
5. Televisions
6. Patch cables and Equipment cords for owner furnished equipment

1.3 ABBREVIATIONS

A. AHJ: Authority Having Jurisdiction

B. EMI: Electromagnetic interference.

C. IDC: Insulation displacement connector.

D. IDF: Intermediate Distribution Frame (Telecom Room)

E. LAN: Local area network.

F. MDF: Main Distribution Frame (Main Telecomm Room)

G. RCDD: Registered Communications Distribution Designer

H. UTP: Unscreened (unshielded) twisted pair

1.4 DEFINITIONS

A. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.

B. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

C. Communications Jack: A fixed connecting device designed for insertion of a communications cable plug.

D. Communications Outlet: One or more communications jacks, or cables and plugs, mounted in a box or ring, with a suitable protective cover.

E. Communication Plug: Also commonly called a "connector," it is the removable, male telecommunications connector.

F. Junction Box: A box with a blank cover that joins different runs of raceway or cable and provides space for connection and branching of the enclosed conductors.

G. Outlet Box: A box that provides access to a wiring system having pryout openings, knockouts, threaded entries, or hubs in either the sides or the back, or both, for the entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting an outlet box cover, but without provisions for mounting a wiring device directly to the box.

H. Plenum: A compartment or chamber to which one or more air ducts are connected and that forms part of the air distribution system.

I. Pull Box: A box with a blank cover that joins different runs of raceway and provides access for pulling or replacing the enclosed cables or conductors.

1.5 REFERENCE STANDARDS

A. Contractor is responsible for knowledge and application of current versions of all applicable standards and codes. In cases where listed standards and codes have been updated, adhere to the most recent revisions, including all relevant changes or addenda at the time of installation.

B. This document does not replace any code, either partially or wholly. Conform to local codes and regulations that apply to this project

C. If there is a conflict between applicable documents, then the more stringent requirement shall apply.

D. Telecommunications Industry Association (TIA):
1. ANSI/TIA-568.0-E, “Generic Telecommunications Cabling for Customer Premises”
2. ANSI/TIA-568.1-E, “Commercial Building Telecommunications Cabling Standards - Part 1 General Requirements”
3. ANSI/TIA-568.2-D, “Balanced Twisted Pair Telecommunications Cabling and Components”
4. ANSI/TIA-568.3-D, “Optical Fiber Cabling Components”
5. ANSI/TIA-568.4-D, “Broadband Coaxial Cabling and Components”
6. ANSI/TIA-569-E, “Commercial Building Standard for Telecommunications Pathways and Spaces”
7. ANSI/TIA-598-D, “Optical Fiber Cable Color Coding”
8. ANSI/TIA-606-C, “Administration Standard for Telecommunications Infrastructure”
9. ANSI-TIA-607-D, “Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises”
10. ANSI/TIA-758-B, “Customer-Owned Outside Plant Telecommunications Infrastructure Standard”
11. ANSI/TIA-1152-A, “Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling”
12. ANSI/TIA-1179-A, “Healthcare Facility Telecommunications Infrastructure Standard”
13. ANSI/TIA-4966, “Telecommunications Infrastructure Standard for Educational Facilities”

E. Building Industry Consulting Service International (BICSI)
1. BICSI TDMM “Telecommunications Distribution Design Manual”
2. BICSI ITSIM “Information Technology Systems Installation Manual”
3. ANSI/BICSI N1, “Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure”
4. ANSI/BICSI N3, “Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure”
5. NECA/BICSI 607 “Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings”
6. ANSI/BICSI 001 " Information and Communication Technology Systems Design and Implementation Best Practices for Educational Institutions and Facilities"
7. ANSI/BICSI 004 "Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities"

1.6 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance configuration with service provider.

2. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.
3. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

B. Pre-installation Meetings

1. Organize pre-installation meeting with telecommunications and LAN equipment suppliers, Engineer, Owner, and service providers to exchange information and agree on details of equipment arrangements and installation interfaces.
2. Record agreements reached in meetings and distribute them to project team.
3. Adjust arrangements and locations of racks, sleeves, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of utility demarcation, and telecommunications and LAN equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

1.7 SUBMITTALS

A. Prior to the start of work the contractor shall submit the following. Work shall not proceed without the Engineer's and Owner's completed review of the submitted items.

B. For Product Data, Equipment Shop Drawings, and Product Schedules: Comply with 260010

C. Coordination Drawings: drawings reviewed and stamped by RCDD with floor plans, sections, riser diagrams, and installation details of telecommunications equipment, to show location and layout of telecommunications equipment, including the following:

a. Telecommunications room plans and rack elevations including workspace requirements and access for cable connections.
b. Telecommunications cable tray and pathway layout with relationships to other building elements.
c. Telecommunications system access points.
d. Telecommunications grounding system.
e. Cross Connects
f. Patch Panels
g. Telecommunications conductor drop locations.
h. Typical telecommunications details.
i. Mechanical, electrical, and plumbing systems.
j. Firestopping

D. Qualification Data for Manufacturer, Contractor, Project RCDD, Project Manager, Lead Technician, and Installers along with project roster of personnel assigned to the project.

E. Sample System Warranties

F. Closeout Submittals
1. As-Built Drawings: Plans showing as-built locations that fully represent actual installed conditions and that incorporate modifications made during the course of construction.
2. Operation and Maintenance Data:
a. In addition to items specified in Section 017823 "Operation and Maintenance Data" and Section 260010 "General Requirements for Electrical Systems" include the following:

1) Cable test results.
2) Manufacturer's recommended maintenance

3. Product and System Warranty Documentation from both manufacturer and contractor.
4. Labeling and Administrative printouts and digital copies on USB media.
   a. Cable Schedule: Install in a prominent location in each equipment room and wiring closet. List incoming and outgoing cables served from that particular room along with their designations, origins, and destinations. Protect with rigid frame and clear plastic cover.
   b. Cabling Administration Drawings: Install in a prominent location in each equipment room and wiring closet. Show building floor plans that identify the location and labelling of Communications devices served out of each telecom room. Protect with rigid frame and clear plastic cover. Identify labeling convention and show labels for telecommunications closets, terminal hardware and positions, backbone and horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.
5. Final test result printouts and backup on USB media.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Five continuous years, minimum, design and manufacture of the materials and equipment specified herein.
2. Manufacturer(s) of products and equipment specified herein shall demonstrate that they have a quality assurance program in place to assure that the specifications are met. Including at a minimum:
   a. Incoming inspection of raw materials
   b. In-process inspection and final inspection of the cable product
   c. Calibration procedures of test equipment to be used in the qualifications of the product
   d. Recall procedures in the event that out of calibration equipment is identified.
3. Conform to government standards on quality assurance for applications within these specifications.

B. Contractor Qualifications: Provide documentation of the following qualifications:

1. Be in business a minimum of 5 continuous years.
2. Provide a minimum of three reference accounts at which similar work, both in scope and complexity, have been completed by The Contractor within the last three years.
3. Demonstrate satisfaction of sound financial condition and can be adequately bonded and insured.
4. Possess licenses/permits required to perform telecommunications installations in the specified jurisdiction.
5. Employ personnel knowledgeable in local, state, province and national codes, and regulations. Comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
6. Possess current liability insurance certificates.
7. Registered with BICSI and have at least one active RCDD on staff who shall be responsible for the implementation of the project.
8. Employ personnel fluent in the use of Computer Aided Design and possess and operate digital design software.
9. The Contractor shall be a certified installer in good standing with the approved manufacturer.

C. Contractor Training: Provide documentation of the following qualifications:

1. Personnel trained and certified in the design and installation of the approved manufacturer's products.
2. Personnel trained and certified in fiber optic cabling, fusion splicing, termination, and testing techniques. Personnel must have successfully attended an appropriate training program, which includes testing with an OLTS and OTDR, and have obtained a certificate as proof thereof.
3. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.

D. Project Personnel Requirements: Contractor must have the following personnel certified by BICSI on staff and assigned to the project.

1. Project RCDD: Preparation of Shop Drawings, cabling administration Drawings, and field-testing program development by an RCDD who shall be a full-time employee of the installing contractor, shall be familiar with the project, and conduct weekly inspections.
2. Project Manager: Minimum BICSI certified Registered Telecommunications Project Manager (RTPM) who shall attend all project meetings and oversee/coordinate all work at the project site.
3. Lead Technician: Minimum BICSI certified Technician who shall provide direct supervision of Installers and be present at all times when work of this Section is performed at the project site.
4. Installers: Personnel installing any part of the structured cabling system shall be a minimum BICSI certified Level 1 Installer or shall have equivalent training and certification from the approved manufacturer.

E. References: The Owner may, with full cooperation of The Contractor, visit client installations to observe equipment operations and consult with references. Specified visits and discussion shall be arranged through The Contractor; however, The Contractor personnel shall not be present during discussions with references.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Environmental Limitations: Do not deliver or install equipment, cables, and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

B. Visually inspect cables upon receipt at Project site. If damage is suspected, test cables to verify and validate the manufacturer’s factory testing certifications.

1. Test optical fiber cable to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
2. Test each pair of UTP cable for open and short circuits.
3. Test each coaxial cable on reel for continuity.

C. Comply with manufacturer's storage and handling requirements for each product.

D. Maintain factory wrapping or provide a heavy canvas/plastic cover to protect units from dirt, water, construction debris, and traffic.

E. Do not install damaged materials and equipment.

F. Return visibly damaged products to the supplier and replace at no additional cost to the Owner.

1.10 GENERAL PRODUCT WARRANTY

A. General Requirements: Comply with additional requirements in contract general requirements and extended warranties required in other specification sections. Refer to all other Division 27 sections for specific additional warranty requirements that exceed or are in addition to those of this section.

B. Provide all services, materials, and equipment necessary for successful operation of entire telecommunications system including but not limited to structured cabling system, pathways, grounding, and bonding system, and firestopping for a period of one year after system acceptance. Scope of warranty includes all equipment, devices, wiring, accessories, software, hardware, installation, programming, and configuration required to maintain a complete and operable system. Provide manufacturer's published recommended preventative maintenance procedures during warranty period. This shall apply to all items except those specifically excluded, or items wherein a longer period of service and warranty is specified or indicated. All warranties shall be effective for one year, minimum, from date Certificate of Final Acceptance is issued. Use of systems provided under this section for temporary services and facilities shall not constitute final acceptance of work nor beneficial use by Owner and shall not institute warranty period. The warranty shall cover repair or replacement of defective materials, equipment, workmanship, and installation that may be incurred during this period. Warranty work is to be done promptly and to Owner's satisfaction. In addition, warranty shall cover correction of damage caused in making necessary repairs and replacements under warranty. Additional warranty responsibilities are:

1. Obtain written equipment and material warranties offered in manufacturer's published data without exclusion or limitation, in Owner's designated name. Replace material and equipment that require excessive service during guarantee period as determined by Owner.
2. Provide 2-business day service beginning on date of Substantial Completion and lasting until termination of warranty period. Service shall be at no cost to Owner. Service can be provided by installing contractor or by a separate service organization. Choice of service organization shall be subject to Owner's approval. Submit name and a phone number that will be answered on a 24-hour basis each day of week, for duration of service.
3. Submit copies of equipment and material warranties to Owner before final acceptance.
4. At end of warranty period, transfer manufacturers' equipment and material warranties still in force to Owner, at no additional costs to the Owner.
5. If warranty work problems cannot be corrected immediately to Owner's satisfaction, advise Owner in writing, describing efforts to correct situation, and provide analysis of cause for problem. If necessary to resolve problem, provide at no cost services of manufacturer's engineering and technical staff at site in a timely manner to analyze warranty issues, and develop recommendations for correction, for review and approval by Owner.

1.11 ADVANCED SYSTEM WARRANTY

A. The structured cabling system shall be covered by a two-part system performance and extended product warranty guaranteed for a minimum of 25 years. The advanced system warranty shall ensure installation and system performance for the duration of the warranty period.

B. The first part is an assurance program, which guarantees the end-to-end link transmission performance conforms to the applicable performance standards specified herein and will support the applications for which it is designed for the duration of the warranty period.

C. The second portion of the certification is an extended product warranty provided by the manufacturer and the contractor on all structured cabling products within the system (cords, telecommunications outlet/connectors, cables, cross-connects, patch panels, fiber panels, etc.).

D. The contractor shall have the sole responsibility for following the manufacturer's conditions and terms for the installation to qualify for the advanced system warranty. Requirements may include but are not limited to:
1. Layout and Installation by a manufacturer approved installer with BICSI certification.
2. Submission of warranty pre-approval, final application, test reports, and bill of materials in a timely manner.
3. Certification testing of all links to appropriate standards.
4. Use of manufacturer approved and calibrated test equipment.
5. Coordination of pre-construction conference.
6. Coordination of Manufacturer Pre/Post Installation Inspection.

PART 2 - PRODUCTS

2.1 GENERAL

A. Electrical Components, Devices, and Accessories: Provide listing and labels as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Materials used shall present no environmental or toxicological hazards as defined by current industry standards and shall comply with OSHA and EPA standards, other applicable federal, state, and local laws.

C. Product numbers are subject to change by the manufacturer without notification. In the event a product number is invalid or conflicts with the written description, notify the Engineer in writing prior to ordering the material and performing installation work.

2.2 SUBSTITUTIONS

A. Conform to the substitutions requirements and procedures outlined in Division 01 and Section 260010 "General Requirements for Electrical Systems".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions, stated under other sections, are acceptable for installation in accordance with manufacturer's instructions.

3.2 DEMOLITION

A. In addition to demolition requirements in Division 01 and Division 26, disconnect and remove abandoned communications cabling back to its source. This includes sources that are outside of the boundaries of the project area.

B. For abandoned cabling deemed unfeasible to remove by the Engineer, tag and label at both ends as Abandoned.

C. The owner shall have first right of refusal for any components of the telecommunications system removed during demolition.

3.3 INSTALLATION

A. Comply with NECA 1

B. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communication equipment and other nearby installations. Connect in such a way as to facilitate future maintenance with minimum interference from other items in the vicinity.

C. Under no condition shall the Contractor install any equipment or component that will void Manufacturer warranty or create such conditions that will reduce equipment performance, longevity, and life.

3.4 FIELD QUALITY CONTROL

A. Tests: Conduct tests of equipment and systems to demonstrate compliance with requirements specified. Reference individual Specification Sections for required tests. Document tests and include in Operation and Maintenance Manuals.

3.5 CLEANING

A. In addition to cleaning requirements in Division 01 and Division 26, thoroughly clean exposed portions of equipment upon completion of installation. Remove temporary labels and traces of foreign substances. Remove construction debris and surplus materials accumulated during work.

B. Leave finished work and adjacent surfaces in neat, clean condition with no evidence of damage.

C. Repair or replace damaged installed products.

3.6 SYSTEM ACCEPTANCE

A. System cannot be considered for final acceptance until work is completed and demonstrated to Engineer that installation is in strict compliance with Specifications, Drawings, and manufacturer's installation instructions, particularly in reference to following:

1. Testing Reports
2. Cleaning
3. Operation and Maintenance Manuals
4. Training of Operating Personnel
5. Record Drawings
6. Warranty Certificates, including extended manufacturer's warranties.

END OF SUPPLEMENTAL REQUIREMENTS FOR COMMUNICATIONS

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, Section 260010 “General Requirements for Electrical”, and 270010 “Supplemental Requirements for Communications” apply to this Section.

1.2 SUMMARY

A. Description: The telecommunications bonding and grounding system and its interconnections to the electrical system provide an electrically continuous, low impedance path for all connected telecommunications equipment and pathways.

B. Section Includes:

1. Bonding conductors.
2. Bonding connectors.
3. Bonding busbars.

C. Related Requirements:
1. Refer to Section 260526 “Grounding and Bonding for Electrical Systems” for requirements associated with Electrical System Grounding, Equipment Grounding System, and Grounding Electrode System.

1.3 REFERENCES

A. Abbreviations

1. TBC: Telecommunications Bonding Conductor.
2. SBB: Secondary Bonding Busbar (Formerly TGB).
3. PBB: Primary Bonding Busbar (Formerly TMGB).
4. RBB: Rack Bonding Busbar
5. TBB: Telecommunications Bonding Backbone
6. BBC: Backbone Bonding Conductor
7. TEBC: Telecommunications Equipment Bonding Conductor
8. RBC: Rack Bonding Conductor

B. Definitions

1. Service Provider: The operator of a service that provides telecommunications transmission delivered over access provider facilities.
2. Grounding: Establishing a direct or indirect connection to Earth or some conducting body that serves in place of Earth.
3. Bonding: Method by which all non-energized conductive materials are effectively interconnected to create a low impedance path.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. Building Industry Consulting Service International (BICSI)

a. ANSI/BICSI N3-20 “Planning and Installation Methods for the Bonding and Grounding of Telecommunication and ICT Systems and Infrastructure”

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Field Quality Control Reports: Provide test reports for each test specified in the field quality control section. Include certificate of current equipment calibration.

C. Closeout Submittals:

1. Operation and Maintenance Data: In addition to the items specified in Division 01 and Section 260010 “General Requirements for Electrical” include the following:

a. Results of the ground-resistance and bonding resistance tests.
b. Include recommended testing intervals

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

C. Comply with NFPA 70, TIA-607, and ANSI/BICSI N3.

2.2 CONDUCTORS

A. Insulated Copper Conductors: Comply with Section 260519 “Low-Voltage Electrical Power Conductors and Cables”.

1. Ground wire for custom-length equipment bonding jumpers: minimum No. 6 AWG.

2.3 CONNECTORS

A. Comply with requirements in 260526 “Grounding and Bonding for Electrical Systems”.

2.4 TELECOM BONDING BUSBARS

A. Manufacturers: Subject to compliance with requirements, provide products from one of the following:

1. Harger Lightning and Grounding
2. Panduit Corp.
3. Erico
4. Chatsworth CPI
5. Ortronics
6. Eaton

B. General Requirements:

1. Predrilled BICSI/TIA-607 style hole pattern for use with lugs specified in this Section.
2. Mounting Hardware: Stand-off brackets that provide a minimum of 4-inch clearance to access the rear of the busbar. Provide stainless steel brackets and bolts.
3. Stand-off insulators for mounting shall be Lexan or PVC. Comply with UL 891 for use in 600-V switchboards, impulse tested at 5000 V.
4. Busbar length: Size to accommodate initial conductors plus a 50% growth factor.

C. Primary Bonding Busbar (PBB): Predrilled, wall-mounted, rectangular bars of electro-tin plated copper, 1/4 by 4 inches in cross section, minimum 24 inches in length or as indicated on Drawings. NRTL listed for use as PBB, complying with UL 467 and TIA-607.

D. Secondary Bonding Busbar (SBB): Predrilled, wall-mounted rectangular bars of electro-tin plated copper, 1/4 by 2 inches in cross section, minimum 12 inches in length or as indicated on Drawings. NRTL listed for use as a SBB, complying with UL 467 and TIA-607.

E. Rack Bonding Busbar (RBB): Comply with requirements for rack busbars in Section 271100 “Communications Equipment Room Fittings”.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the ac grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of the electrical system.

B. Inspect the test results of the ac grounding system measured at the point of TBC connection.

C. Prepare written report, endorsed by Installer, listing any conditions detrimental to performance of the Work.

D. Proceed with connection of the TBC only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Bonding shall include the ac utility power service entrance, the communications cable entrance, and the grounding electrode system. The bonding of these elements shall form a loop so that each element is connected to at least two others.

B. Comply with NECA 1.

C. Comply with NFPA 70, TIA-607, and ANSI/BICSI N3.

3.3 APPLICATION

A. Conductors: Install solid conductor for No. 8 AWG and smaller and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

1. The bonding conductors between the PBB/SBB and structural steel of steel-frame buildings shall not be smaller than No. 6 AWG.

B. Conductor Terminations and Connections:

1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

C. Conductor Support:

1. Secure grounding and bonding conductors at intervals of not less than 36 inches.

D. Grounding and Bonding Conductors:

1. Install in the straightest and shortest route between the origination and termination point, and no longer than required. The bend radius shall not be smaller than ten times the diameter of the conductor. No one bend may exceed 90 degrees.
2. Install without splices.
3. Support at not more than 36-inch intervals.
4. Install grounding and bonding conductors in minimum 1-inch Schedule 80 PVC conduit where exposed to physical damage or where routed through building walls or footings. Provide EMT conduit for the grounding and bonding conductor pathway where installed in a plenum.

a. If a grounding and bonding conductor is installed in ferrous metallic conduit bond the conductor to the conduit at both ends using a grounding bushing that complies with requirements in Section 270528, “Pathways for Communications Systems”.

3.4 GROUNDING ELECTRODE SYSTEM

A. Provide a Telecommunications Bonding Conductor (TBC) between the PBB and the electrical service equipment ground busbar no smaller than No. 1/0 AWG and no smaller than the Telecommunications Bonding Backbone (TBB).

B. Where external equipment ground busbar is not available, provide intersystem bonding termination (IBT) device for connecting telecommunications bonding conductor (TBC) with service busbar.

C. Comply with requirements in article 250.94 of the National Electric Code (NEC)

3.5 TELECOM BONDING BUSBARS

A. Provide PBB in main telecommunications equipment room and locate to minimize length of TBC.

B. Provide SBB in each telecom room.

C. Install PBB/SBB horizontally, on insulated spacers 4 inches minimum from wall, 48 inches above finished floor unless otherwise indicated.

D. Install RBB on rack or cabinet using stand-off block insulators to provide a minimum of 0.75 inches of separation for dissimilar metals and to facilitate conductor attachment to RBB. The RBB may be directly mounted/bonded to the rack or cabinet only if doing so allows adequate space for attaching grounding conductors and does not create a dissimilar metals reaction.

3.6 CONNECTIONS

A. Bond all metallic equipment and pathways in each telecommunications room to the bonding busbar in that room, using insulated grounding conductors not smaller than No. 6 AWG.

B. Stacking of conductors under a single bolt is not permitted when connecting to busbars.

C. Assemble the wire connector to the conductor, complying with manufacturer's written instructions and as follows:

1. Use crimping tool and the die specific to the connector.
2. Pre-twist the conductor.

D. Clean and apply an antioxidant compound to all bolted and compression connections.

E. Building Entrance Protectors: Bond to the PBB/SBB with insulated bonding conductor.

F. Busbar Interconnections: Interconnect all SBBs with the PBB using a continuous telecommunications bonding backbone (TBB). If more than one TBB is installed, interconnect TBBs using the backbone bonding conductor (BBC) conductor at the top floor and at every third floor in between. The telecommunications bonding backbone and backbone bonding conductor size shall not be less than 2 kcmils/linear foot of conductor length, up to a maximum size of 750 kcmil unless otherwise indicated.

G. Telecommunications Enclosures and Equipment Racks/Cabinets: Bond metallic components of enclosures to the telecommunications bonding and grounding system. Connect the Telecommunications Equipment Bonding Conductor (TEBC) to the Rack Bonding Busbar (RBB) and to the rack/cabinet using a Rack Bonding Conductor (RBC) and listed compression two hole lugs.

H. Structural Steel: Where the structural steel of a steel frame building is readily accessible within the room or space, bond each SBB and PBB to the vertical steel of the building frame.

I. Electrical Power Panelboards: Where an electrical panelboard for telecommunications equipment is located in the same room or space, bond each PBB/SBB to the equipment ground bar of the panelboard.

J. Shielded Cable: Bond the shield of shielded cable to the PBB/SBB in communications rooms and spaces. Comply with TIA-568.1 and TIA-568-.2 when grounding shielded balanced twisted-pair cables.

K. Rack- and Cabinet-Mounted Equipment: Bond powered equipment chassis to the rack bonding busbar (RBB) using unit bonding conductors (UBC). Power connection shall comply with NFPA 70; the equipment grounding conductor in the power cord of cord- and plug-connected equipment shall be considered as a supplement to bonding requirements in this Section.

L. Ladder Rack and Cable Tray: Bond ladder rack/cable tray system to the PBB/SBB using manufacturer approved ground lugs and bonding conductors. Remove paint from the ladder rack/cable tray to ensure ground lugs contact bare metal.

M. Metallic Conduits: In telecommunications rooms, bond metallic conduits longer than 24-inches to the PBB/SBB using insulated ground bushing sized for the conduit and ground conductor to be attached.

3.7 IDENTIFICATION

A. Comply with requirements in Section 270553 - Identification for Communications Systems.

3.8 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
2. Bond Resistance Test: Test the bonding connections of the system using a certified micro-ohmmeter, taking two-point bonding measurements in each telecommunications equipment room containing a PBB/SBB and using the process recommended by BICSI TDMM. Conduct tests with the facility in operation.

    a. Measure the resistance between the following:
        1) Each PBB/SBB to the nearest electrical equipment ground.
        2) Each PBB/SBB to the structural steel.
        3) PBB to each SBB.
        4) Structural steel to the electrical ground.

    b. The maximum acceptable value of this bonding resistance is 100 milliohms.

3. Test for ground loop leakage currents using a certified digital clamp-on earth ground tester, with a full-scale of not more than 10 A, displaying current in increments of 0.01 A at an accuracy of plus/minus 2.0 percent.

    a. With the grounding infrastructure completed and the communications system electronics operating, measure the current in every conductor connected to the PBB and in each SBB. Maximum acceptable ac current level is 1 A.

B. Excessive Ground Resistance: If resistance to ground at the TBC exceeds 5 ohms, notify Engineer promptly and include recommendations to reduce ground resistance.

C. Grounding system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

END OF GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, Section 260010 “General Requirements for Electrical Systems”, and 270010 “Supplemental Requirements for Communications” apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Conduits and fittings.
2. J-Hooks.
3. Boxes, enclosures, and cabinets.

1.3 REFERENCES

A. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. Building Industry Consulting Service International (BICSI)
   a. ANSI/BICSI N1 “Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure.”

1.4 SUBMITTALS

A. Product Data: For each product type indicated.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to authorities having jurisdiction and marked for intended location and application.

2.2 CONDUITS AND FITTINGS

A. Comply with 260533 “Raceways and Boxes for Electrical Systems”.

B. Conduit Bodies

1. Telecommunications style with standards based internal bend radius control.

2.3 J-HOOKS

A. Description: Comply with UL 2239, single and multi-tiered prefabricated sheet metal wide base cable supports with integral bend radius support for telecommunications cable.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:

1. Panduit
2. Legrand
3. Eaton B-Line
4. nVent Caddy
5. Thomas & Betts

C. Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Material: Galvanized steel.

E. J shape.

F. UL 2043 and CAN/ULC S102.2 listed and suitable for use in air handling spaces.

G. Pre-riveted assembly allowing for attachment to walls, ceilings, beams, threaded rods, drop wires and underfloor supports to meet requirements of application indicated.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Comply with 260533 “Raceways and Boxes for Electrical Systems”.

B. General Requirements for Boxes, Enclosures, and Cabinets used for communications:

1. Device Box Dimensions:

a. Minimum 4 inches square by 3-1/2 inches for 1-inch pathways.
b. Minimum 4-11/16 inches square by 3-1/2-inch deep box for pathways 1-1/4 inches and larger.

2. Gangable boxes are prohibited.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Comply with requirements in Section 260533 - Raceways and Boxes for Electrical Systems for pathway application except as noted below

B. Minimum Pathway Size: 1-inch trade size.

1. For Cat6A cable applications: minimum 1-1/4-inch trade size.

C. Install surface pathways only where indicated on Drawings or where approved by Engineer.

D. Use of flexible conduit is prohibited.

3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements indicated on Drawings or in this Section are more stringent:

1. NECA 1.
2. ANSI/BICSI N1.
3. TIA-569.
4. NECA 101.
5. NECA 111.

B. Comply with requirements in Section 260500 – Common Work Results for Electrical Systems for hangers, supports, and sleeves.

C. Comply with requirements in Section 260533 - Raceways and Boxes for Electrical Systems for installation of raceways and fittings except as noted below:

D. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction.

E. Utilize manufactured sweeps and long radius elbows for all optical-fiber cables.

F. Raceways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 1-Inch Trade Size and Larger: Install pathways in maximum continuous lengths of 100-feet.
2. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
3. Minimum Bend Radius
   a. For trade size conduits 2-inch or less, provide inside bend radius at least 6 times the internal diameter of the raceway.
   b. For trade size conduits greater than 2-inch, provide inside bend radius at least 10 times the internal diameter.
4. Pull boxes should be readily accessible and should be installed in straight sections of conduit and not used in place of a bend.
5. Provide a conduit stub-up for each outlet box unless noted otherwise.

G. J-Hooks:

1. Size to allow a minimum of 25 percent future capacity without exceeding design capacity limits.
2. Provide dedicated support wires, threaded rod, beam clamps, or strut. Do not use ceiling grid support wire or support rods.
3. Install at spacing intervals to allow no more than 6-inches of slack and to provide a minimum of 6-inches of clearance from the lowest point of the cables to ceilings,

mechanical ductwork and fittings, luminaires, power conduits, power, and telecommunications outlets, and other electrical and communications equipment.

4. Maximum Spacing: 4-feet on center.
   a. For Cat6A installations: 3-foot on center.
5. Provide a hook at each change in direction.
6. Do not exceed load ratings specified by manufacturer.
7. Do not install J-hooks that cannot be maintained without removal of another system.
8. Provide additional tiers where required to meet fill capacity and load rating requirements or to separate low voltage systems with varying voltage and power limitations.

3.3 PROTECTION

A. Protect installed cables in open cabling systems:

1. Install temporary protection for cables in open pathways to safeguard exposed cables against paint overspray, falling objects or debris during construction.
2. Replace any cable exposed to paint overspray or other foreign substance that voids the cable warranty, at no cost to the owner.
3. Temporary physical protection for cables and J-hooks can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.

END OF PATHWAYS FOR COMMUNICATIONS SYSTEMS

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, Section 260010 “General Requirements for Electrical”, and 270010 “Supplemental Requirements for Communications” apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Color and legend requirements for labels and signs.
2. Labels.
3. Signs.
4. Cable ties.

B. Related Requirements

1. Refer to Section 260553, “Identification for Electrical Systems” for additional requirements related to labeling of electrical equipment and cabling.

1.3 REFERENCES

A. Definitions

1. Identifier: An item of information that links a specific element of the telecommunications infrastructure with its corresponding record.

B. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified

1. Underwriters Laboratories Inc (UL)

a. UL 969, “Marking and Labeling Systems”

1.4 SUBMITTALS

A. Product Data: For each product type.

B. Identification Schedule: System Labeling Schedules with proposed designations for cables, outlets, terminations, and equipment.

1.5 COORDINATION

A. All identifications shall be consistent with the owner's standard practices, especially within existing facilities, unless otherwise require by codes. Where the requirements herein are in conflict, the contractor shall notify the engineer in writing prior to ordering any material.

B. All room names and/or numbers for labeling or programming shall use the Owner's approved room name and numbering scheme, not names and numbers indicated on floor plans. All reprogramming shall be included as required to accommodate construction phasing.

C. Coordinate with Owner for approval of all labelling codes and schemes prior to creation and installation of labeling system.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Comply with NFPA 70 and TIA 606 for a Class 2 system.

B. Comply with UL 969 for Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Labels shall be designed to remain permanently affixed and shall not fade under typical environmental conditions for the life of the product identified.

D. Thermal Movements: Allow for thermal movements from ambient temperatures up to 120-deg F and surface temperatures up to 180-deg F.

E. Provide mechanically printed black letters on a white field unless noted otherwise.

F. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady
2. Brother
3. Dymo
4. HellermanTyton
5. Panduit

2.2 LABELS AND TAGS

A. Heat Shrink Tubes: Flame-retardant shrinkable polyolefin tube with thermal transfer-printed identification label. Sized to suit diameter of cable and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F.

B. Self-Adhesive Labels: Thermal transfer-printed, minimum 3-mil- thick, flexible labels with acrylic pressure-sensitive adhesive.
1. Wraparound Vinyl or Nylon Cloth Type: Repositionable for wrapping and flagging flexible cables.
2. Self-Laminating Vinyl Type: Clear wrap around tail shield laminates the entire printed legend for abrasion, UV-, weather- and chemical-resistance on flexible cables.
3. General Purpose Polyester Type: for component labelling on flat surfaces.

C. Marker Plate Tags: Thermal transfer printed, UV, weather, and chemical resistant polyolefin suitable for large cables or bundles. Pre-punched holes for attachment with cable ties.

2.3 SIGNS AND NAMEPLATES

A. Engraved Plastic Signs and Nameplates:

1. 3-layer melamine plastic laminate
2. Weather and UV-resistant for Wet and Damp Locations.
3. Thickness:

a. For signs up to 20 sq. in., minimum 1/16 inch thick.
b. For signs larger than 20 sq. in.or 8 inches in length, 1/8 inch thick.
c. Engraved designation with black letters on white face
d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting. Exception for locations where specifically approved contact type permanent adhesive may be used where screws cannot or should not penetrate substrate.
e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.4 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system suitable for surface material and location (exterior or interior).

B. Fasteners for Labels and Signs:
1. Self-tapping, stainless-steel screws, or stainless-steel machine screws with nuts and flat and lock washers.
2. Pop-Rivets.
3. Two-Part Epoxy Adhesive

C. Cable Ties: Self-extinguishing, one-piece, self-locking, UV-stabilized or plenum rated where required by installed environmental conditions. 3/16-inch minimum width.

PART 3 - EXECUTION

3.1 CABLING ADMINISTRATIVE DRAWINGS

A. Provide professionally produced, scaled drawings using Computer Aided Design software identifying the location and labelling of Communications devices served out of each telecom room.

B. Print on Arch D or E1 size paper and install in a prominent location in each equipment room and wiring closet so as not to interfere with future equipment installation.

C. Provide rigid frame and 1/8-inch clear plastic protective overlay.

D. Supply separate drawings for each Communications Room.

3.2 INSTALLATION

A. Mechanically produce all labels. Write-on labels are not permitted.

B. Install identifying devices before installing acoustical ceilings or similar concealment.

C. Verify identity of each item before installing identification products.

D. Self-Adhesive Identification Products: Before applying communications identification products, clean substrates of substances that could impair bond using materials and methods recommended by manufacturer of identification product and manufacturer of substrate to retain product warranties.

E. For surfaces that require a finish, apply identification devices to surfaces after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of communications systems and connected items.

G. Install all labels in a neat manner, plumb and parallel to equipment lines.

H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

I. Provide labels within 12-inches from cable termination points and secure tight to surface at a location with high visibility and accessibility for ease of identification after termination.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Equipment Room Racks, Cabinets, and Frames:

1. Identify top and bottom, front and rear of each with self-adhesive engraved laminated plastic nameplate containing rack or cabinet identifier (xy).
2. Label Size: minimum 2-inches in height with letters no less than 1-1/2-inches tall.

C. Rack Patch Panels and Fiber Enclosures:

1. Label each fiber enclosure and patch panel with a letter (-r) designating the order of the panel from the top of the cabinet or frame.
2. Label each fiber enclosure adapter panel with self-adhesive label indicating range of port numbers.
3. Label fiber enclosure cover with self-adhesive labels indicating each backbone cable link identifier including:

a. Near end port numbers
b. Far end building identifier (b) for inter building cable
c. Far end Telecomm space identifier (fs)
d. Far end rack identifier (xy)
e. Panel identifier (-r)
f. Panel port numbers (:p)

4. Label each patch panel port or group of ports with a self-adhesive label or manufacturer provided insert indicating the following:

    a. Room number of outlet being served.
    b. Faceplate number.
    c. Patch panel port number

5. Use manufacturer provided labels and mounting surfaces wherever possible.

D. Wall Punchdown Blocks
1. Label each cable termination position with a sequential number designator.
2. Where insert type labels are used, install clear plastic cover over mechanically produced labels.
3. Use manufacturer provided labels and mounting surfaces wherever possible.

E. Backbone Cables:
1. Label each cable with a thermal transfer marker tag indicating the backbone cable link identifier including the following:

    a. Strand/pair count and cable type
    b. Near end identifier and far end identifier including:

        1) Building identifier (b) for inter building cable
        2) Telecomm space identifier (fs)
        3) Rack identifier (xy)
        4) Panel identifier (-r)
        5) Port grouping(:p)

2. Label Backbone cables at termination points and entrance/exit point of telecom space.
3. Outside plant pathways: In addition to labels at termination points, label each backbone cable at all manholes, handholes, and pull points where cable enters and exits pathway.

F. Horizontal Cables:
1. Label each cable with a vinyl self-laminating label indicating the horizontal cabling link identifier including:

    a. Room and faceplate number.
    b. Telecomm Space identifier (fs)
    c. Rack identifier (xy)
    d. Patch Panel identifier (-r)
    e. Patch Panel port number (:p)

2. Outside plant pathways: In addition to labels at termination points, label each cable at manholes, handholes, and pull points where cable enters and exits pathway.

G. Faceplates:

1. Label individual faceplates with self-adhesive labels or manufacturer provide insert. Place label at top of faceplate. Each faceplate shall be labeled with its individual, sequential designation**,** numbered clockwise when entering room from primary egress, indicating the following:

    a. Room number of outlet
    b. Faceplate number.

2. Label each individual jack within the same faceplate with its horizontal link identifier.

H. Telecommunications Bonding Busbars and Conductors

1. Label each Busbar with a self-adhesive label indicating the following:

   a. Telecomm space identifier (fs)
   b. Busbar identifier

2. Label each bonding conductor with a vinyl self-laminating label indicating the far end busbar or object identifier
3. Label each bonding conductor at its attachment point with a thermal transfer marker tag with the following.

   a. WARNING: IF CABLE OR CONNECTOR IS LOOSE OR MUST BE REMOVED, PLEASE CONTACT TELECOMMUNICATIONS MANAGER.

4. Warning labels: yellow marker plate type with black print.

I. Underground duct and raceway

1. Label both ends of each underground duct and raceway with self-adhesive label indicating the following:
   a. Pathway Identifier and sequence number
   b. Far End Building Identifier (b)
   c. Far End Telecomm Space Identifier (fs)
   d. Far End Outdoor Space Identifier (T)

END OF IDENTIFICATION FOR COMMUNICATION SYSTEMS

SECTION 27 15 00 - COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, Section 260010 “General Requirements for Electrical”, and 270010 “Supplemental Requirements for Communications” apply to this Section.

1.2 SUMMARY

A. Horizontal Cabling Description

1. Horizontal cable and its connecting hardware provide means of transporting signals between a telecommunications outlet/connector and the horizontal cross connect located in a telecommunications room. The cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection. This cabling and its connecting hardware are called a “permanent link,” a term that is used in the testing protocols.
2. A work area is approximately 100 sq. ft. and includes the components that extend from the equipment outlets to the station equipment.
3. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

B. Section Includes:

1. Twisted Pair Cabling
2. Twisted pair cable connecting hardware, including patch panels and cross connects
3. Telecommunications outlets/connectors, including plugs and jacks.
4. Grounding provisions for twisted pair cable.
5. Source quality control requirements for twisted pair cable.

1.3 REFERENCES

A. Abbreviations

1. EMI: Electromagnetic Interference
2. IDC: Insulation Displacement Contact
3. UTP: Unshielded Twisted Pair

B. Definitions

1. Horizontal Cabling: Distribution media that connects the telecommunications outlet/connector at the work area and the horizontal cross-connect in the telecommunications room or enclosure.

2. Telecommunications Outlet: An assembly consisting of a faceplate, backbox, or supporting bracket, and one or more receptacles or jacks of a telecommunication connector. Also known as a work area outlet.

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest version as of the date of the Contract Documents, unless otherwise specified.

1. Building Industry Consulting Service International (BICSI)

a. ANSI/BICSI N1, “Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure”

1.4 SUBMITTALS

A. Product Data: For each type of product.

B. Twisted Pair and Coaxial Cable Testing Plans:
1. Sample test report sheet for each type of test required
2. Description of the cable testing procedures to be used including equipment to be used and testing standards equipment will test to.

C. Closeout Submittal
1. Operation and Maintenance Data: In addition to the items specified in Division 01 and Section 260010 “General Requirements for Electrical” include the following:
a. Cable Test Results

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with minimum performance values listed herein and transmission standards in TIA-568.1, when tested according to test procedures of this standard.

2.2 GENERAL CABLE CHARACTERISTICS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with the applicable standard, UL 444, and NFPA 70 for the following types:

1. Plenum Applications: Type CMP complying with NFPA 262.
2. Non-plenum applications: Type CMR complying with UL 1666.
3. Wet Location and Outdoor Applications: OSP.

B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 50 or less.

C. RoHS compliant.

2.3 PREMIUM PERFORMANCE CATEGORY 6 TWISTED PAIR CABLE

A. pair cable, with internal separator, certified to meet transmission characteristics of Category 6 cable at frequencies up to 400MHz and a minimum +7 dB margin for internal crosstalk parameters.

B. Manufacturers: Subject to compliance with requirements, provide product indicated or approved equal by one of the following

1. Berk-Tek Leviton LANmark 2000
2. General Cable GenSPEED 6500
3. Belden DataTwist 4800
4. Siemon Premium 6
5. Superior Essex NextGain

C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568.2 for Category 6 cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP) unless noted otherwise.

F. Jacket: Blue thermoplastic unless noted otherwise.

2.4 ENHANCED SMALL DIAMETER CATEGORY 6a TWISTED PAIR CABLE

A. Description: Four-pair, small diameter, balanced-twisted pair cable, with internal separator, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz and minimum +4 dB margin for alien crosstalk parameters.

B. Manufacturers: Subject to compliance with requirements, provide product indicated or approved equal by one of the following

1. Berk-Tek Leviton LANmark RDT
2. General Cable GenSPEED 10 MTP
3. Belden 10GXS
4. Siemon Category 6a GT
5. Superior Essex 10GainXP

C. Standard: Comply with TIA-568.2 for Category 6a cables.

D. Conductors: 100-ohm, 23 AWG solid copper.

E. Shielding/Screening: Unshielded twisted pairs (UTP) with overall discontinuous shield.

F. Jacket: Blue thermoplastic unless noted otherwise.

2.5 TWISTED PAIR CABLE HARDWARE

A. Description: Hardware designed to connect, splice, and terminate twisted pair copper communications cable.

B. General Requirements for Twisted Pair Cable Hardware:

1. Comply with the performance requirements of the twisted pair cabling.
2. Comply with TIA-568.2, IDC type, with modules designed for punch-down caps or tools.
3. Cables shall be terminated with connecting hardware of same category or higher.

C. Source Limitations: Obtain twisted pair cable hardware from same manufacturer or alliance partner as twisted pair cable.

D. Expansion Criteria: Unless otherwise noted, provide spare positions in cross connects and patch panels to accommodate 20% future growth.

E. Connecting Blocks:

1. 110-style IDC
2. 50, 100, and 300 pair footprint.
3. Supports termination of 22-24 AWG solid conductors.
4. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.

F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between horizontal and backbone cables.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Management rings shall be provided between vertical columns of blocks to provide management of cross connect wire.

G. Modular Patch Panel: Metal patch panel with numbered jack units that accept modular type connectors at each jack location for permanent termination of pair groups of installed cables.

1. Features:
    a. Universal T568A and T568B wiring labels.
    b. Labeling areas adjacent to conductors.
    c. Replaceable connectors.
    d. 24 or 48 ports.
    e. Strain Relief Bar
2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
3. Number of Jacks per Field: One for each four-pair cable indicated, plus spares and blank positions adequate to suit specified expansion criteria.

H. Patch Cords: Factory-made, four-pair cables in various lengths; terminated with an eight-position modular plug at each end.

1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
2. Patch cords shall have color-coded boots for circuit identification.
3. Patch cords shall match performance rating of horizontal link.

I. Plugs and Plug Assemblies:

1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable, rated to match performance of horizontal link.
2. Standard: Comply with TIA-568.2.
3. Marked to indicate transmission performance.

J. Modular Jacks and Jack Assemblies:

1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair, 100-ohm, unshielded or shielded twisted pair cable, rated to match performance of horizontal link.
2. Designed to snap-in to a patch panel or faceplate.
3. Standard: Comply with TIA-568.2.
4. Marked to indicate transmission performance.

K. Faceplate:

1. Four port, vertical single gang faceplates designed to mount to single gang wall boxes.
2. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
3. For use with snap-in modular jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

L. Surface Mount Box

1. Four port, low profile, surface mount housing, with removeable cover.
2. Plastic housing suitable for installation in plenum air handling spaces. Coordinate color with Section 262726 "Wiring Devices."
3. For use with snap-in modular jacks accommodating any combination of twisted pair, optical fiber, and coaxial work area cords.

M. Legend:

1. Machine printed, in the field, using adhesive-tape label.

PART 3 - EXECUTION

3.1 WIRING METHODS

A. Wiring Method: Install cables in raceways and cable trays, except within consoles, cabinets, desks, and counters. Conceal raceway and cables, except in unfinished spaces.

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications Systems."
3. Unenclosed wiring methods may be used in accessible ceiling spaces.

B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

C. Wiring within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools. Install conductors parallel with or at right angles to sides and back of enclosure.

3.2 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

A. General Requirements for Cabling:

1. Provide a minimum of two equipment jacks for each work area outlet unless noted otherwise.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications equipment outlet.
3. Bridged taps and splices shall not be installed in the horizontal cabling.
4. Do not untwist twisted pair cables more than 1/2 inch from the point of termination to maintain cable geometry.
5. Maintain the cable jacket to within 1-inch of the termination point.
6. Provide horizontal cabling with the following minimum bending radius:
    a. Twisted Pair Cable: 4 times the outside diameter of the cable.
    b. Coax Cable: 10 times the outside diameter of the cable.
7. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
8. Coordinate with owner requirements for use of T568A or T568B standard for terminations.
9. Coil cables in the outlet boxes if adequate space is present to house the cable coil without exceeding the cable bend radius.
10. Store no more than 12-inches of twisted pair and 36-inches of fiber optic cable in an outlet box or modular furniture raceway after termination. Loosely store excess slack in the ceiling above each drop location.
11. In the telecommunications room, provide minimum 10-foot of slack for all horizontal cables and dress/store on ladder rack system without exceeding the cable bend radius.
12. Store cable slack in a Figure 8, “U” or “S” pattern.
13. MUTOAs shall not be used as a cross-connect point.
14. Provide consolidation point and cabling listed for wet locations at floor boxes in slab-on grade construction.:
    a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
    b. Locate consolidation points for twisted-pair cables at least 49 feet from communications equipment room.
15. The same orientation and positioning of jacks and connectors shall be utilized throughout the installation.
16. Provide blank filler inserts for all unused work area faceplate ports.
17. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
18. Cables shall be neatly bundled and dressed into groups of no more than 48 cables and routed from the point of entrance into the telecommunications space to their respective patch panel or connecting block.
19. Each patch panel or connecting block shall be fed by individual bundles separated and dressed with hook and loop straps.
20. Install lacing bars and distribution spools to restrain cables, prevent straining connections, and maintain minimum bending radii.
21. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation, and replace it with new cable.
22. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.

23. Pulling Cable: Comply with BICSI Information Technology Systems Installation Methods Manual (ITSIMM), "Copper Structured Cabling Systems," "Pulling and Installing Cable" Section. Monitor cable pull tensions.
24. Under no circumstances shall the cable or patch cords be painted, treated, or covered with other material unless approved by the manufacturer, Owner, and Engineer.

B. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable management in telecommunications spaces with terminating hardware and interconnection equipment.
2. Cable shall not be run through structural members, attached to ceiling grid/luminaire supports, or in contact with pipes, ducts, or other potentially damaging items.
3. Cable and support hardware shall not obstruct access to panels, equipment, valves, boxes, or other control devices.

C. Group connecting hardware for cables into separate logical fields.

D. Separation from EMI Sources:

1. Comply with recommendations from BICSI's "Telecommunications Distribution Methods Manual" and TIA-569 for separating unshielded copper communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

4. Separation between communications cables in grounded metallic raceways, power lines, and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

   a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
   b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
   c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches .

5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.3 IDENTIFICATION

A. Provide identification of cabling and devices in accordance with Section 270533 “Identification for Communications Systems”.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections on all new and modified cabling and termination hardware.

B. Tests and Inspections:

1. Visually inspect jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA-568.1.
2. Visually confirm Category marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Field-test instruments shall be approved by the cable manufacturer, be within the calibration period recommended by the instrument manufacturer and meet a minimum Level IV accuracy in accordance with TIA-1152. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. Twisted Pair Continuity Tests:

    a. Test twisted pair cabling for shorts, opens, intermittent faults, polarity, and pair reversals, crossed pairs, and split pairs. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

6. Twisted Pair Performance Tests:

    a. Test each cable link to the performance requirements outlined in this specification and manufacturer’s warranty requirements. Perform the following tests according to TIA-568.1, TIA-568.2, and TIA-1152:

        1) Wire Map
        2) Length (physical vs. electrical, and length requirements).
        3) DC resistance.
        4) DC resistance unbalance.
        5) Insertion loss.
        6) Near-end crosstalk (NEXT) loss.
        7) Power sum near-end crosstalk (PSNEXT) loss.
        8) Equal-level far-end crosstalk (ELFEXT).
        9) Power sum equal-level far-end crosstalk (PSELFEXT).
        10) Return loss.
        11) Propagation delay.
        12) Delay skew.

7. Final Verification Tests: Perform verification tests for UTP systems after the complete communication cabling and workstation outlet/connectors are installed.

    a. Voice Tests: After dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
    b. Data Tests: After Owner’s Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.

C. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similarly to Table 10.1 in BICSI's "Telecommunications Distribution Methods Manual," or shall be transferred from the instrument to the computer, printed, and submitted unaltered.

D. End-to-end cabling will be considered defective if it does not pass tests and inspections. Marginal passes are not acceptable.

E. Remove, replace, and re-test cabling and terminations where test results indicate that they do not comply with specified requirements.

F. Prepare test and inspection reports.

G. The Engineer may request that a 10% random field re-test be conducted on the cabling system, at no additional cost, to verify documented findings. Tests shall conform to the requirements listed above. If findings contradict the documentation submitted by the contractor, additional testing can be requested to the extent deemed necessary by the Engineer, including a 100% re-test. Any re-testing shall be at no additional cost to the Owner.

END OF COMMUNICATIONS HORIZONTAL CABLING

SECTION 28 46 00 - ADDRESSABLE FIRE ALARM SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General, Special and Supplementary Conditions, Division 01 Specification Sections, and Section 260010 “General Requirements for Electrical Systems” apply to this Section.

1.2 SUMMARY

A. Description: This section of the specification includes the furnishing, installation, connection, and testing of the microprocessor controlled, intelligent reporting fire detection equipment required to form a complete, operative, coordinated system.

B. Section Includes:

1. Analog-Addressable fire-alarm system.
2. Fire-alarm control unit (FACU).
3. Manual fire-alarm boxes.
4. System Detectors.
5. Fire-alarm notification appliances.
6. Fire-alarm annunciators.
7. Fire-alarm addressable interface devices.
8. Fire-alarm system communications.
9. Fire-alarm system accessories.
10. Fire-alarm conductors and cabling.

1.3 REFERENCES

A. Abbreviations and Acronyms

1. DACT: Digital alarm communicator transmitter.
2. FACU (FACP): Fire-alarm control unit (panel).
3. NAC: Notification Appliance Circuit
4. NICET: National Institute for Certification in Engineering Technologies.
5. NRTL: Nationally Recognized Testing Laboratory.
6. SLC: Signaling Line Circuit

B. Definitions

1. Circuit: Wire path from a group of devices or appliances to a control panel or transponder.
2. Zone: Combination of one or more circuits or devices in a defined building area

C. Reference Standards: The following publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

1. National Electrical Contractors Association (NECA):

a. NECA 305, “Standard for Fire Alarm System Job Practices”.

1.4 COORDINATION

A. Testing existing system: Provide a complete functional test of the existing fire alarm systems prior to commencement of work. Report any non-functioning equipment or components to Architect and Engineer. After commencing work, Contractor shall be responsible for ensuring all existing portions of the fire alarm system are properly functioning at all times with no trouble conditions.

B. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. When new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from building.

C. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment indicated for removal along with all associated wiring.

D. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Engineer and Owner no fewer than 10 days in advance of proposed interruption of fire-alarm service.
2. Identify specific locations affected by interruption, circuits which may be inoperable during the outage, and the length of time the system will be impaired.
3. Do not proceed with interruption of fire-alarm service without the Owner's written permission.

E. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.5 SUBMITTALS

A. Approved Permit Submittal: Submittals must be approved by authorities having jurisdiction prior to submitting them to Architect.

B. Product Data: For each type of product, including furnished options and accessories.

C. Shop Drawings: Provide for the fire alarm system.

1. Comply with recommendations and requirements in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Include floor plans drawn to scale which clearly show locations of devices, equipment. Indicate electrical power connections, approximate location and size of conduit/wiring runs, and other information required to clearly describe the proposed system. Plans should include identification numbers and wiring connections for all equipment and devices in entire fire alarm system.
3. Include enlarged plans, drawn to a scale not less than 1/4 -inch equals 1 foot, for all equipment rooms and any fire command centers with dimensioned equipment layouts.
4. Include detailed riser diagrams based on the project floor plans, with all devices indicated along with proposed circuit routing. The conductor composition for each conduit section shall be provided. Show consecutive connections for all devices with addresses, candela ratings, and speaker wattages.
5. Provide scaled elevations, sections, and details, including critical dimensions and details of attachments to other Work.

6. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
7. Detail assembly and support requirements.
8. Annunciator panel details as required by authorities having jurisdiction.
9. Include current draw for each device submitted and the listed minimum voltage required to operate.
10. Include voltage drop calculations for notification-appliance circuits. Provide maximum allowable voltage drop for panel and for individual NAC circuits.
    a. Identify Notification Appliance Circuits (NAC) current draws and voltage drops for each circuit. Vendor must utilize the “end of line” method for voltage drop calculations. The “mid-point” method is not acceptable. In no case shall the calculated voltage at any notification appliance fall below the minimum listed operating voltage for the devices used.
    b. The voltage drop at EOL must not exceed 14% of the expected battery voltage, after the required standby time plus alarm time. Determine "worst case" voltage at far end of each NAC, by subtracting its calculated V-drop from the expected battery voltage. The result must be no less than the minimum listed operating voltage for the alarm notification appliances used. All these calculations must be placed on a dedicated sheet, for future reference by fire alarm service technicians.
11. Include battery-size calculations showing battery capacity and supervisory and alarm standby power requirements.
    a. Use manufacturer's battery discharge curve to determine expected battery voltage after specified time period of providing standby power. Then use calculated Notification Appliance Circuit current draw in the alarm mode to determine expected voltage drop at End of the Line Resistor (EOL), based on conductor resistance per conductor manufacturer's data sheet or NEC.
12. Include system response matrix showing the fire alarm system's actions (outputs) required for each type of alarm, supervisory, and trouble signal. Any non-compliant features must be fully described.
13. Include written statement from manufacturer that equipment and components have been tested as a system and comply with requirements in this Section and in NFPA 72.
14. Include performance parameters and installation details for each type of detector.
15. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
16. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
    a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
    b. Provide control wiring diagrams and show equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
    c. Locate detectors in accordance with manufacturer's written instructions.
17. Include equipment rack or console layout, grounding schematic, power calculations, and single-line connection diagram.
18. Include manufacturer's detailed installation instruction for the Fire Alarm Control Panel and all duct mounted smoke detectors, flow switches, tamper switches, supervisory switches, and similar items which require mechanical installation.

D. Delegated Design: For notification appliances and detectors, in addition to submittals listed herein, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by qualified professional responsible for their preparation.

1. Drawings showing location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of device.
2. Design Calculations: Calculate requirements for selecting spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

E. Qualification Data: For Certified System Designer, Lead Technician, and Installers including names, license numbers, and certifications as described under Quality Assurance.

F. Sample Warranty.

G. Field quality-control reports.

H. Closeout Submittals

1. Operation and Maintenance Data: For fire-alarm systems and components to include in operation and maintenance manuals.
2. In addition to items specified in Division 01 and Section 260010 "General Requirements for Electrical Systems", include the following:
   a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
   b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
   c. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
      1) Equipment tested.
      2) Frequency of testing of installed components.
      3) Frequency of inspection of installed components.
      4) Requirements and recommendations related to results of maintenance.
      5) Manufacturer's user training manuals.
   d. Software and Firmware Operational Documentation: Provide operating manuals and backups of software database on USB media. The database provided shall be useable by any authorized and certified distributor of the product line and shall include all applicable passwords necessary for total and unrestricted use and modification of the database.

1.6 MAINTENANCE MATERIAL

A. Extra Stock Materials: Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.
2. Manual Fire Alarm Boxes: 2% of installed quantity.
3. Audible and Visual notification appliances: 1% of installed quantity for each type.
4. Addressable Detectors/Bases: 2% of installed quantity for each type.
5. Addressable Control Relays: 1% of installed quantity.
6. Monitor Modules (Addressable Interface): 1% of installed quantity.
7. Isolation Modules/Isolation Bases: 1% of installed quantity.
8. Keys and Tools: Two extra sets for access to locked or tamper-proofed components.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications

1. Manufacturer must be regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products are Listed and Labeled.
2. Manufacturer shall maintain an authorized distributor within 100 miles of the project location which stocks a full complement of parts for all equipment to be furnished.

B. Installer Qualifications

1. Obtain certification by NRTL in accordance with NFPA 72.
2. Licensed or certified by authorities having jurisdiction to perform fire alarm installations in the specified jurisdiction.
3. Be in business a minimum of 5 continuous years with documented experience installing fire alarm systems similar in size and scope.
4. Installer must be responsible for all program changes and must be present for all testing and inspections.
5. All connections to the FACP and the system's programming shall only be done by the manufacturer, or by an authorized distributor.

C. Project Personnel Requirements: Installer must have the following certified full-time employees on staff and assigned to the project.

1. All personnel must be trained and certified by manufacturer for installation of units required for this Project.
2. System Designer: Preparation of shop drawings, cabling administration drawings, and field-testing program development by a NICET certified Level IV technician who shall be trained and certified in fire alarm system design by the approved manufacturer within the last 36 months and be licensed by the authorities having jurisdiction.
3. Lead Technician: Minimum NICET certified Level III technician who shall provide all devices, connections, and programming for the fire alarm system. Technician shall be certified by the approved manufacturer within the last 36 months and licensed by the authorities having jurisdiction. The lead technician shall be present at all times when work of this Section is performed at the project site.
4. Installer Qualifications: Any work related to this section shall be installed by personnel trained and certified by the approved manufacturer within the last 24 months.

1.8 WARRANTIES

A. Manufacturer Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship for a period of 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency acceptable to the authority having jurisdiction and marked for intended location and application.

B. All components provided shall be listed for use with the selected system.

2.2 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the following:

1. Edwards EST
2. Notifier
3. Siemens by Distribution Channel Only
4. Simplex

B. Being listed as an acceptable Manufacturer in no way relieves obligation of the Contractor to provide all equipment and features in accordance with these specifications.

C. Existing Equipment: Components must be compatible with and operate as extension of the existing fire alarm system. Equipment must not impair reliability or operational functions of the existing system. Provide system manufacturer's certification that components provided have been tested as, and will operate as, a system.

2.3 ADDRESSABLE FIRE ALARM SYSTEM REQUIREMENTS

A. Noncoded, UL-certified, FM Global-approved, analog/addressable system, with multiplexed signal transmission and voice/strobe evacuation.

B. The system shall be designed, inspected, tested, and approved to provide occupant notification audibility levels of 15 dBA over ambient conditions. Design intelligibility to ensure Common Intelligibility Standard (CIS) rating of 0.7 or Sound Transmission Index of 0.5 in all areas designated on the drawings to have intelligible audio.

C. Fire Alarm System shall supervise and monitor the integrity of all sub-systems, circuits, and devices connected to the system and annunciate all system faults. All intelligent initiating, signaling, and control devices shall be individually addressed.

D. The system shall be fully programmable so that any type of input event can be correlated to any combination of output functions.

E. The fire alarm system operational priority shall ensure that life safety functions takes precedence over other activities coordinated by the system.

2.4 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations.
2. Heat detectors.
3. Smoke detectors.
4. Automatic sprinkler system water flow.
5. Fire standpipe system.
6. Dry system pressure flow switch.
7. Fire-suppression/extinguishing system operation.

B. Fire-alarm signal must initiate the following actions:

1. Continuously operate alarm notification appliances, including voice evacuation.

2. Identify alarm and specific initiating device at fire-alarm control unit and any remote annunciators or network connected control panels. The system alarm LED shall flash and a local distinct audible signal in the control panel shall sound.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Switch HVAC equipment controls to fire-alarm mode.
7. Close smoke dampers in air ducts of designated air-conditioning duct systems.
8. Activate emergency lighting control.
9. Record events in system memory.
10. Record events by system printer.
11. Indicate device in alarm on graphic annunciator.

C. Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch.
2. Duct smoke detectors.
3. Device tamper.
4. Zones or individual devices have been disabled.
5. High- or low-air-pressure switch of dry-pipe or pre-action sprinkler system.
6. Elevator shunt-trip supervision for Shut-Down.
7. Elevator hoistway detectors for Recall.
8. Carbon Monoxide detectors.
9. Fire-suppression/extinguishing system trouble.

D. System Supervisory Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit and remote annunciators. The corresponding system LED shall flash and a local distinct audible signal in the control panel shall sound.
2. Record the event on system printer.
3. Transmit a supervisory signal to the remote alarm receiving station with no time delay.

E. System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of communication with any addressable device or networked panel.
4. Loss of primary power at fire-alarm control unit.
5. Ground or a single break in internal circuits of fire-alarm control unit.
6. Abnormal AC voltage at fire-alarm control units.
7. Break in standby battery circuitry.
8. Failure of battery charging.
9. Abnormal position of any switch at fire-alarm control unit or annunciator.
10. Voice signal amplifier failure.
11. Smoke Detector Contamination.
12. Carbon Monoxide Detector End of Life.

F. System Trouble Signal Actions:

1. Identify specific device initiating the event at fire-alarm control unit and remote annunciators. The system trouble LED shall flash and a local distinct audible signal in the control panel shall sound.
2. Record the event on system printer.

3. Transmit a trouble to the remote alarm receiving station after a programmable time delay of 200 seconds or as required by AHJ.
4. A trouble signal from loss of primary power shall not be transmitted unless maintained after a programmable time delay of 1 to 3 hours or as required by AHJ.
5. Fire alarm signal shall override trouble signals, but any pre-alarm trouble signal shall reappear when the panel is reset.

2.5 FIRE ALARM CONTROL PANEL (FACP)

A. General Requirements for Fire Alarm Control Panel:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with NFPA 72 and UL 864, and protected from voltage surges and line transients.

    a. System software and all control-by-event programs shall be held in nonvolatile memory, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    b. Include a real-time clock for time annotation of events on the event recorder and printer. Time-of-Day and date shall be retained through failure of primary and secondary power supplies.
    c. The Central Processing Unit (CPU) shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection, or failure of any control panel module shall be detected and reported to the system display by the CPU.
    d. Provide communication between the FACP and intelligent detectors, addressable modules, local and remote operator terminals, remote circuit interface panels, annunciators, and other system-controlled devices.
    e. The FACP shall be listed for connection to a central-station signaling system service.
    f. The system is to have multiple access levels, so owner's authorized personnel can disable individual alarm inputs or normal system responses (outputs) for alarms, without changing the system's executive programming or affecting operation of the rest of the system. A minimum of two different password levels shall be accessible through the display interface assembly to prevent unauthorized system control or programming.

2. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
3. The system shall perform time-based control functions including automatic changes of specified smoke detector sensitivity settings.
4. Digitized electronic signals shall employ check digits or multiple polling. In general, a single ground or open on any system signaling line circuit shall not cause system malfunction, loss of operating power, or the ability to report an alarm.
5. Loss of Power: Alarm signals arriving at the main FACP shall not be lost following a power failure (or outage) until the alarm signal is processed and recorded.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, three lines of 80 characters, minimum.
2. Alphanumeric Touch Keypad: Arranged to permit entry and execution of programming, display, and control commands.

3. Color coded system status LEDs. At minimum, Indicate the status of the following system parameters:
   a. System AC Power
   b. System Common Alarm
   c. System Common Trouble
   d. System Supervisory
   e. Signal Silence
4. Provide operator's interface which allows the following minimum functions. In addition, the operator's interface shall support any other functions required for system control and/or operation:
   a. Signal Silence Switch: Silenced audible signal shall resound in a time period acceptable to AHJ if the condition has not been resolved.
   b. System Reset Switch
   c. System Test Switch
   d. Panel Silence Switch
   e. Panel Lamp Test Switch
   f. System Bypass Switches: Programmable, supervised switches for fire safety function bypasses. i.e. NAC Bypass, Elevator Capture Bypass, HVAC Shutdown Defeat, Smoke Control Bypass, etc. Switch operation shall be password protected.
   g. Interface shall allow programming of the system without any external programming equipment. Systems that require the use of external programmers or change of EPROMs are not acceptable.

C. Notification-Appliance and Signaling-Line Circuits:

1. Signaling Line Circuits (SLC): NFPA, Class B.
   a. Provide a minimum of one signaling line circuit per floor.
   b. Locate end of line resistors
2. Notification Appliance Circuits (NAC): NFPA 72, Class B.
3. SLC Between Networked Panels: NFPA 72, Class X.
4. Door Hold Open control circuits: NFPA 72, Class D for fail safe operation.
5. Size each signaling line circuit and notification appliance circuit to allow a minimum additional capacity of 20%.

D. Signaling Line Circuit (SLC) Modules:

1. Power limited, capable of accommodating up to 198 addressable devices on each SLC and a minimum of 1980 initiating points per system.
2. On-board microprocessor capable of operating in a local mode in the event of a failure in the main CPU of the control panel.
3. Capable of receiving analog information from all intelligent detectors and processing the information to determine whether normal, alarm, or trouble conditions exist for specific detectors.
4. Automatically maintain detector desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. Analog information may also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.

E. Notification-Appliance Circuit (NAC) Modules:

1. Power limited, minimum circuit output rating: 2 Amps at 24VDC.
2. Polarized to provide for both synchronized strobes operation over two wires.
3. Selectable as auxiliary power outputs and rated for continuous duty.

F. Network Communication

1. Provide a dedicated fiber optic TCP/IP network utilizing listed network components to interconnect multiple FACPs.
2. Synchronize panel time, signal patterns, and indicator flash rates across all panels on the network.
3. In the event of network wiring faults, each panel on the network shall re-configure into a sub-network and continue to respond to alarm events.

G. Digital, Multiplexed Voice/Alarm Signaling: Emergency communication system, integral to FACP, with master and remote microphones, zoned amplifiers, and tone generators that provide both live and pre-recorded messages.

1. Indicate number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the microphones. Amplifiers shall comply with UL 1711. Group speakers into zones as required by building code.

    a. Allow the application of, and evacuation signal to, multiple zones and, at the same time, allow voice paging to the other zones selectively or in any combination.
    b. Programmable tone and message sequence selection.
    c. Provide standard digitally recorded messages for the following:
        1) Evacuation
        2) All Clear
        3) Weather warning
        4) Test
        5) Stand-by
    d. Generator tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification-appliance circuits.

2. Status Annunciator: Indicate the status of various voice/alarm speaker zones.
3. Amplifiers and tone generators shall automatically transfer to backup units, on primary equipment failure.

H. Serial Interfaces:
1. One USB port for system printer.
2. One USB or Ethernet port for on-site programming or system modification with a PC.

I. Smoke-Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.

J. Elevator Recall and Shutdown:

1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:

    a. Elevator lobby detectors except the lobby detector on the designated floor.
    b. Smoke detector in elevator machine room/space or control room/space.
    c. Smoke detectors in elevator hoist way.

2. Program elevator controller to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
3. Heat Detectors or Water-flow alarm associated with sprinklers in an elevator shaft and elevator machine room shall remove power to elevators associated with the location without time delay.

    a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

K. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to and powered by fire-alarm system.

L. Remote Smoke-Detector Sensitivity Adjustment and Testing: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory and print out final adjusted values on system printer. The system shall also annunciate a trouble condition when any smoke detector approaches 80% of its alarm threshold due to gradual contamination, with an annunciation of the location of the smoke detector requiring service. If any specialized equipment must be used to program any function of the smoke detector devices, then one must be furnished as part of the system.

M. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station in accordance with parameters specified herein.

N. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

O. Primary Power: Obtained from dedicated 120-V ac branch circuit and a high efficiency power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory and digital alarm communicator transmitters shall be powered by 24-V dc source.

1. Power supply modules shall have a continuous rating adequate to power all equipment and functions in full alarm continuously. All modules and drivers must be able to withstand prolonged short circuits in the field wiring, either line-to-line or line-to-ground, without damage. The power supply shall be expandable for additional notification appliance power in 3.0 Ampere increments.
2. Each system power supply shall be individually supervised.
3. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating to allow for future system expansion.
4. Install lock clips on circuit breakers in the “ON” position.

P. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch for system operation in the event of primary power source failure. Transfer from normal to auxiliary (secondary) power or restoration from auxiliary to normal power shall be automatic and shall not cause transmission of a false alarm.

1. Batteries: Maintenance-free, rechargeable, sealed, lead acid with rated lifespan of 10 years.
2. Provide sufficient capacity to operate the complete alarm system in normal, supervisory, or trouble conditions, including audible trouble signal devices, mode for a period of 24

hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of the system, including all alarm notification devices in alarm mode for a period of 15 minutes. Battery capacity must include a 25% safety factor.

3. Locate batteries either within the control panel or in a separate substantial steel cabinet, finished on inside and outside with enamel paint. Provide a cylinder lock keyed to match FACP. Separate cells to prevent contact between terminals of adjacent cells and between terminals and other metal parts.
4. Battery Charger: Provide solid state automatic float type, capable of dual rate charging techniques that will recharge a fully discharged battery to a minimum 70% capacity in 12 hours or less. Locate charger within the control panel or within the battery cabinet. Provide voltmeter and ammeter to indicate battery voltage and charging current.
5. All standby batteries shall be continuously monitored by the power supply. The power supply shall be able to perform an automatic test of batteries and indicate a trouble condition if the batteries fall outside a predetermined range.

Q. Enclosure: The FACP shall be housed in a listed cabinet suitable for surface or semi-flush mounting. Cabinet and front shall be corrosion protected, given a rust-resistant prime coat, and manufacturer's standard finish. The door shall provide a key lock and shall include a glass or other transparent opening for viewing of all indicators. For convenience, the door may be hinged on either the right or left side (field selectable).

R. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.6 REMOTE POWER SUPPLIES

A. Stand-alone panel capable of powering a minimum of four synchronized NACs. Power limited, 24 VDC, filtered-regulated, and supervised. Configurable as a continuous 24VDC auxiliary power output.

B. Alarms from the host fire alarm control panel shall signal the NAC remote power supply panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.

C. Internal Primary and Secondary power supplies: comply with performance requirements for FACP.

2.7 MANUAL FIRE ALARM BOXES

A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes must be finished in red with molded, raised-letter operating instructions in contrasting color; must show visible indication of operation; and must be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type with visual indicator of operation; with screw terminals and integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control panel. When the station is operated, the handle shall lock in a manner showing visual indication of operation.

2. Station Test/Reset: Key-operated test/reset switch. Stations shall be keyed alike with the fire alarm control panel.
3. Manual pull stations that initiate an alarm condition when opening the unit are not acceptable.
4. Indoor Protective Shield: Where indicated, provide factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
5. Weatherproof Protective Shield: At wet locations, provide factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
6. Material: High impact Lexan Polycarbonate or Cast Metal.
7. Suitable for ambient temperatures up to 120 deg F.
8. Where required, provide weatherproof backbox and device listed for outdoor applications.

2.8 SYSTEM DETECTORS

A. General Requirements:

1. Operating Voltage: 24VDC, nominal. Two-wire type.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to FACP through a SLC.
3. Device Identification: Detectors shall permanently store an internal identifying type code that the control panel shall use to identify the type of device.
4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: dual LED type. LEDs shall flash under normal conditions, indicating that the device is operational and in regular communication with the control panel. The flashing mode operation of the detector LEDs shall be optional through the system field program.
7. Automatic Device Mapping: Detector address must be accessible from FACP and must be able to identify detector's location within system and its sensitivity setting.
8. Detectors shall be rated for operation in the following environment unless noted otherwise:
   a. Temperature: 32 deg F to 120 deg F
   b. Humidity: 0-93% relative humidity, non-condensing
9. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
   a. Multiple levels of detection sensitivity for each sensor.
   b. Sensitivity levels based on time of day.
   c. Automatically compensate for detector sensitivity changes due to ambient conditions and dust build-up within detectors.
10. Test Means: Provide a test means whereby detectors will simulate an alarm condition and report that condition to the control panel. Such a test may be initiated at the detector itself or initiated remotely on command from the control panel when in the "test" condition.

B. Photoelectric Smoke Detector: Comply with UL 268.

1. Intelligent photoelectric smoke detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.
2. Each detector shall utilize an environmental compensation algorithm that shall automatically adjust for background environmental conditions such as dust, temperature, and pressure.

a. Provide a maintenance alert signal when 80% of the available compensation range has been used.
b. Provide a dirty fault signal when 100% or greater compensation has been used.

3. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
   a. Primary status.
   b. Device type.
   c. Present average value.
   d. Present sensitivity selected.
   e. Sensor compensation range (normal, dirty, etc.).

C. Duct Smoke Detector: Comply with UL 268A.

1. Listed for air velocity, temperature, and humidity present in specific duct application with standard Intelligent Photoelectric Detector and detector mounting base.
2. Duct Housing Enclosure: NRTL listed for use with supplied detector for smoke detection in HVAC system ducts. Provide gasketed NEMA 4X housing for harsh environments.
3. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
4. Relay Fan Shutdown: Fully programmable supervised relay rated to interrupt fan motor-control circuit.

D. Heat Detector: Comply with UL 521.

1. Heat detectors shall use an electronic sensor to measure thermal conditions caused by a fire and shall, on command from the control panel, send data to the panel representing the analog level of such thermal measurements.
2. Fixed Temperature Type: Actuated by fixed temperature of 135 deg F unless otherwise required.
3. Combination Type: Actuated by fixed temperature of 135 deg F or rate of rise that exceeds 15 deg F per minute unless otherwise required.
4. Rated for ceiling installation at a minimum of 50 ft centers and suitable for wall mount applications.

E. Multicriteria Detector

1. Multi-criteria optical smoke sensor with integrated rate of rise sensing and optional carbon monoxide detection.
2. Integrated nuisance rejection to reduce unwanted alarms.
3. Provide independent signals to the control panel for detectors with CO sensors.

F. Electro-chemical Carbon Monoxide (CO) Detector: Comply with UL 2075.

1. Initiates a Temporal 4 tone when paired with a sounder base for local audible notification.
2. Transmit a maintenance condition to the control panel when the sensor approaches the end of its useful life.
3. Capable of a functional gas test using a canned test agent to test the functionality of the CO sensing cell.

G. Detector Bases: Suitable for mounting to standard 4-inch octagon or square outlet boxes.

1. Standard Base: Twist lock, suitable for all intelligent detectors. Provided with integral terminal strips for circuit connections, rather than wire pigtails. Capable of supporting a remote alarm indicator light.
2. Relay base: Includes programmable, supervised relay, configurable for control with attached detector or from the FACP. Minimum contact rating of 1 amp at 30VDC and listed for pilot duty.

3. Sounder Base: Includes piezoelectric sounder with configurable low or high output, programmable operation, listed to UL 268. Produces Temporal Code 4 tone for CO detectors and Temporal Code 3 tone for all other detectors. or low frequency 520Hz signal tone patterns.
4. Low Frequency Sounder Base: Emits 520Hz tone as defined by NFPA 72 for sleeping areas, listed to UL 268 and UL 464.
5. Isolator Base: Includes integral isolation module.

2.9 NOTIFICATION APPLIANCES

A. General Requirements

1. Connected to system notification-appliance signal circuits, zoned as noted, equipped for mounting as indicated, and with in and out screw terminals for system connections.
2. All visual appliances shall be synchronized. Light and audible output levels shall be designed to meet ADA and NFPA requirements.
3. Audible/Visual Combination Devices shall comply with all applicable requirements for both Audible Notification and Visible Notification Appliances.
4. Devices located in a damp or wet location shall be listed for environment. Exterior mounted devices shall be provided with a weatherproof backbox.
5. Devices located in sleeping areas shall produce a low frequency alarm signal that has a fundamental frequency of 520Hz +- 10% and shall be a square wave.
6. All notification appliances shall be factory finished red unless noted otherwise on the drawings

B. Fire Alarm Voice-Tone Notification Appliances:

1. Description: Notification appliances capable of outputting voice evacuation messages.
2. Performance Criteria: Comply with UL 1480.
3. Voice-tone appliances shall sound in a three-pulse temporal pattern with a minimum of two cycles preceding and following the voice message, as defined in NFPA 72.
4. Speakers for Voice Notification: Locate speakers for voice notification to provide intelligibility requirements of "Notification Appliances" and "Emergency Communications Systems" chapters in NFPA 72.
5. Speaker Operating Voltage: 25V or 70V.
6. Mounting: Flush mount on a standard electrical box.
7. Minimum rated sound pressure level of 84dBA at 10 feet for 1-watt tap.
8. Matching Transformers: Tap range at 1/4-watt, 1/2-watt, 1-watt, and 2-watt, selected to match acoustic environment of speaker location. Speakers shall be tapped at 1 watt for design purposes.

C. Fire Alarm Visible Notification Appliances: LED strobe lights with clear high impact polycarbonate lens mounted on an aluminum faceplate, complying with UL 1971. The word "FIRE" is engraved in minimum 1-inch- high letters on the housing.

1. Rated Light Output:15/30/75/110cd or 135/177/185cd, switch selectable at the device. Selected strobe rating shall be visible when the horn-strobe is in its installed position.
2. Voltage: 24VDC nominal
3. Mounting: Wall or ceiling mounted to standard electrical box unless otherwise indicated.
4. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
5. Flashing shall be in a temporal pattern, synchronized with other units. Maximum pulse duration: 2/10ths of one second.
6. Strobe Leads: Factory connected to screw terminals.

D. Bell: Vibrating under dome type with 10-inch gong, utilize a heavy-duty mechanism, polarized for supervised operation.

1. Voltage: 24VDC nominal.
2. Mounting: Semi-Flush mount on a standard electrical box.

2.10 ANNUNCIATORS

A. Fire Alarm Remote Annunciator

1. Description: Annunciator functions must match those of FACP for alarm, supervisory, and trouble indications. Manual switching functions must match those of FACP, including acknowledging, silencing, resetting, and testing.
2. Mounting: Flush cabinet, NEMA 250, Type 1.
3. Annunciator shall communicate with the fire alarm control panel via a supervised RS-485 communications loop that supports multiple annunciators and shall individually annunciate all zones in the system.
4. Display Type and Functional Performance: Large format LCD Alphanumeric display and LED indicating lights must match those of FACP. Provide manual control switches to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
5. Power shall be supplied directly from the FACP or listed auxiliary power supply, ensuring a reliable and monitored power source.
6. Provide remote microphone to facilitate live page announcements over the FACP system from the remote annunciator. The remote microphone shall feature a Push-to-Talk switch, local and remote page active LEDs, and a trouble LED.

B. Fire Alarm Graphic Annunciator Panel: Mounted in aluminum frame with nonglare, minimum 3/16-inch thick, clear acrylic cover over graphic representation of facility. Detector locations must be represented by red LED lamps. Normal system operation must be indicated by lighted, green LED. Trouble and supervisory alarms must be represented by amber LED.

1. Comply with UL 864.
2. Operating voltage must be 24 VDC provided by local battery backed up 24 V power supply provided with annunciator.
3. Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and lamp test switch.
4. Semi flush mounted in NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
5. Graphic representation of facility must be CAD drawing and each initiating device must be represented by LED in its actual location. CAD drawing must be at 1:100 scale or larger.
6. LED representing detector must flash two times per second while detector is in alarm.

2.11 ADDRESSABLE INTERFACE DEVICES

A. General Requirements:

1. Arrange to monitor or control one or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and control of building systems.
2. All Circuit Interface Devices shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions.
3. Each module shall be equipped with two (2) diagnostic indicators; a green LED to confirm communications and a red LED to display active status. LEDs shall be visible through the finished cover plate. The module shall be capable of storing a unique serial number and

up to 24 diagnostic codes, hours of operation, number of alarms and troubles, and time of last alarm in its memory which can be retrieved for troubleshooting.

4. Include electronic address-setting means on the module.

B. Monitor Module: Microelectronic module providing system address for alarm-initiating devices in wired applications with normally open contacts.

1. Supervision: Unless specifically noted otherwise on the drawings provide one monitor module for each sprinkler flow, tamper, and pressure switch.

C. Control Relay Module: For control of auxiliary devices or equipment.

1. Provide form C dry relay contacts rated 24VDC at 2 amps.

D. Isolation Module: For short circuit protection on signaling line circuits.

1. When a short circuit is detected, the module isolates the affected segment on the circuit, allowing the remaining devices to continue functioning.
2. Self-restoring and automatically reconnects to the circuit segment when the fault is removed.
3. SLC isolation shall be provided for each floor or protection zone of building.

2.12 DIGITAL ALARM COMMUNICATIONS

A. UL 864 listed as conforming to the requirements of NFPA 72 for Central Station connections.

B. Digital alarm communications transmitter (DACT): capable of sending system events to remote central station receivers over conventional telephone lines.

1. Dual telephone line, rotary or touch-tone-dial DACT interface to public switched telephone network

C. IP/Cellular digital alarm communications transmitter (IP DACT): capable of sending system events to compatible remote central station receivers over a cellular or IP path.

1. UL 864 listed as conforming to the requirements of NFPA 72 for Central Station connections.
2. TCP/IP Ethernet Communicator supporting encrypted communications.
3. Cellular Communicator: LTE fall back cellular connection through the cellular module. Provide antenna extension kits where required to ensure a high-quality connection.

D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture a transmission line and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If primary service is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of primary line to the remote alarm receiving station over the remaining transmission line. Transmitter shall automatically report transmission channel restoration to the central station. If service is lost on both transmission channels, transmitter shall initiate the local trouble signal.

E. Digital Data Transmission must include the following at a minimum:

1. Address of alarm-initiating device.
2. Address of supervisory signal.
3. Address of trouble-initiating device.
4. Loss of ac supply, exceeding programmable time delay.
5. Loss of power.
6. Low battery.
7. Abnormal test signal.

8. Communication bus failure.

F. Local functions and display at the digital alarm communicator transmitter shall include the following:
1. Supervised communications.
2. Programmable
3. Auxiliary relay to indicate alarm or trouble.
4. LED display with audible trouble alarm.
5. Manual test report function and manual transmission clear indication.
6. Communications failure with the central station or fire-alarm control unit.

G. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.13 SYSTEM ACCESSORIES

A. Magnetic Door Holders: wall or floor mounting and complete with matching doorplate. The door portion shall have a plated steel pivot mounted armature with shock absorbing nylon bearing. Material and finish to match door hardware.

1. Operation: Under normal conditions, the magnets shall attract and hold the door open. Upon activation of the building fire alarm system, the devices shall be de-energized, thus releasing the doors on the circuit.
2. Electromagnets: Require no more than 1 W to develop 35-lbf holding force.
3. Wall-Mounted Units: Flush mounted in a single gang electrical box unless otherwise indicated.
4. Rating: 24-V dc operating on power from the fire alarm control panel.
5. Power source shall be supervised.
6. Door hold open magnets shall be furnished with keepers, door chains, and other accessories as required to properly hold open doors as indicated on the Drawings.
7. Operation: Under normal conditions, the magnets shall attract and hold the door open. Upon activation of the building fire alarm system, the devices shall be de-energized, thus releasing the doors on the circuit.

B. Surge Suppression Devices:

1. AC circuits: UL 1449 listed, 120VAC, 20A branch circuit surge suppressor with EMI filtering. Ditek DTK-120SRD or equal. Shunt type devices are not permitted.
2. DC circuits: UL 497B listed, 24VDC, 5A multi stage hybrid design surge suppressor. Ditek DTK-2MHLP24BWB or equal. Devices using only MOV active elements are not permitted.

C. Wire Guards: Welded steel wire mesh of size and shape for manual stations, detectors, strobes, or other devices requiring protection.

1. Guard design shall not affect performance of device.
2. Factory fabricated and furnished by manufacturer of device.
3. Finish: Paint of color to match the protected device.

D. Remote Alarm Indicator Lights: Key type switch for testing of the annunciated device.

E. Terminal Cabinets: Steel cabinet with red finish, hinged cover, identification labels, and listed terminal blocks for up to 120 high barrier termination points. Terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

2.14 SYSTEM PRINTER

A. Dot Matrix printer, listed and labeled as an integral part of fire-alarm system. Tractor feed type that uses ordinary (non-thermal) paper.

B. The printer shall timestamp such printouts with the current time-of-day and date. The printer shall be standard carriage with 80-characters per line and shall use standard pin-feed paper. Thermal printers are not acceptable. The printer shall operate from a 120 VAC, 60 Hz power source. Provide table and stand for printer.

C. In the event that the printer is off-line when an event is received, a panel buffer shall retain the data and it shall be printed when the printer is restored to service.

2.15 FIRE ALARM CONDUCTORS AND CABLE

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Wiring and Cable
2. Belden
3. Comtran Corporation
4. General Cable
5. Honeywell Genesis
6. Radix Wire & Cable
7. Southwire
8. Superior Essex
9. West Penn Wire

B. General Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.

1. Type FPLR or FPLP, red jacket, suitable for indoor locations.
2. Type PLTC, suitable for underground or wet locations.
3. Twisted, shielded pair, low capacitance, not less than No. 18 AWG unless recommended otherwise by system manufacturer.
4. Circuit Integrity Cable: Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.

1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed before installation begins.

B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

A. All equipment supplied must be specifically listed for its intended use and shall be installed in accordance with the manufacture’s recommendations. The contractor shall consult the manufacturer's installation manuals for all wiring diagrams, schematics, physical equipment sizes, etc., before beginning system installation.

B. Comply with NECA 305, NFPA 70, NFPA 72, and requirements of AHJ for installation and testing of fire-alarm equipment. Install electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."

1. Devices placed in service before all other trades have completed cleanup shall be replaced.
2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.

C. Securely fasten all system components to wall and ceiling assemblies using fasteners and supports rated to support the required load in accordance with Section 260500, “Common Work Results for Electrical Systems”.

1. Ceiling mounted devices shall not be supported solely by suspended ceilings.

D. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above finished floor. Locate annunciators at a height that enables easy viewing.

E. Provide additional remote NAC power supplies as required to comply with voltage drop requirements.

F. Manual Fire-Alarm Boxes:

1. Install manual fire-alarm boxes in the normal path of egress within 60 inches of the exit doorway.
2. Mount manual fire-alarm box on a background of a contrasting color.
3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.

G. Notification Devices:

1. Comply with NFPA 72 and ADA criteria for strobe visual intensity, audible appliance intelligibility, and final device placement.
2. Install wall devices with entire lens between 80-inches and 96-inches above the floor but not less than 6 inches below the ceiling. Install devices on flush-mounted back boxes with the audible device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.

H. End of Line (EOL) Resistors: Label devices containing end-of-line resistors with NAC panel and circuit number in such a manner that removal of the device is not required to identify the EOL device. Locate EOL devices in a readily accessible location no more than 12-feet above finished floor.

I. Smoke and Heat Detectors:

1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.

3. Smooth ceiling spacing for smoke detectors shall not exceed 30 feet except in corridors where increased spacing are allowed in accordance with NFPA 72.
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
5. HVAC: Locate detectors not closer than 36 inches from diffusers or return-air openings.
6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
7. When installed in a room, detectors shall be oriented, so their alarm light is visible from the nearest door to the corridor.
8. Unless suitably protected against dust, paint, etc., spot type smoke detectors shall not be installed until the final construction clean-up has been completed. In the event of contamination during construction, the detectors must be replaced by the contractor at no additional cost to the Owner. Covers supplied with smoke detector heads do not provide protection against heavy construction dust, spray painting, etc., and must not be used for that purpose. They are suitable only during final, minor cleanup or touchup operations.

J. Duct Smoke Detectors: Comply with NFPA 72, IMC, and NFPA 90A for HVAC system shutdown and closing of smoke dampers. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches long shall be supported at both ends. Extend the intake tube through the far side of the duct, seal around the tube where it penetrates the duct wall and plug the end with a rubber stopper to facilitate visual inspection and intake tube cleaning.

1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to final acceptance.
2. Locate duct detectors in a manner that provides suitable, convenient access for required periodic cleaning and calibration.
3. Comply with manufacturer’s requirements for clearances from HVAC equipment and duct accessories such as humidifiers.
4. The numbers of detectors per duct shall be per NFPA 72 requirements based on the size of the air duct, air duct configuration, air speed, and duct manufacturer’s installation requirements.
5. Indicate airflow direction on the duct, adjacent to the detector, using stencil or permanent decal.
6. Provide each duct smoke detector with a remote keyed test switch and alarm indicator.

K. Remote Status and Alarm Indicators: Install in visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position and where indicated. Locate in the nearest corridor or public area and identify with engraved label.

L. Carbon Monoxide Detectors:

1. Ceiling mounted CO detectors should be kept 12-inches from sidewalls.
2. Wall mounted CO detectors should be at least 48-inches above the finished floor, but less than 6-inches from the ceiling.
3. Locate at least 60-inches from fuel burning appliances.
4. Install CO detectors no closer than 36 inches from air supply diffusers or return-air openings.

M. Elevator Hoistway and Machine/Control Rooms and Spaces: Provide initiating devices and elevator controls interface to comply with NFPA 72 and ANSI A17.1 elevator code requirements for elevator recall and shutdown.

1. Coordinate initiating device temperature ratings, sensitivity settings, and location with sprinkler rating and location. Select temperature rating nominal 10 degrees F less than the adjacent fire sprinkler.

2. Ensure device operating ranges for temperature and humidity are suitable for installed environment. Do not install smoke detectors in un-sprinklered elevator hoistway unless required otherwise by AHJ.

N. Addressable Interface Modules:

1. Addressable interface and control modules (used to monitor all contact type initiating devices) must be in a conditioned space, unless they are tested, listed, and marked for continuous duty across the range of temperatures and humidity expected at their installed location.
2. Sprinkler system supervisory circuits for monitoring valve position, air pressure, water temperature, pump status, etc., must cause distinct audible and visible indications at the FACP.
3. Install interface devices no more than 36 inches from the device controlled.

O. Isolation Modules: Provide in the following locations to minimize the impact of wiring faults:
1. After each 50 initiating devices and control points on the addressable loop, or a lesser number where recommended by the manufacturer.
2. Near the point any addressable circuit extends outside the building, except for those attached to the building exterior walls and well sheltered by walkways.
3. For loops covering more than one floor, install isolator at terminal cabinet on each floor with additional isolator[s] on any floor with over 50 addresses.
4. Each isolation module must be clearly labeled, readily accessible for convenient inspection (not above a lay-in ceiling).

P. HVAC Unit Shutdown

1. All shutdown relays must be directly controlled and monitored by the fire alarm system. The Building Automation System (BAS) shall not be used for life safety functions unless the BAS is supervised by the Fire Alarm System for off normal conditions. Relays should be wired fail safe.
2. A supervised "AHU Shutdown Defeat" switch must be provided in/adjacent to the FACP with an informative engraved label at the FACP about this function. The switch must cause a system "trouble" indication when it's placed in the off-normal ("Shutdown Defeated") position. This is to provide the owner with a convenient means to temporarily resume HVAC operation in the event an unwanted alarm will not clear, prior to arrival of the fire alarm service technician, or for testing purposes.

3.3 PATHWAYS AND CONDUCTORS

A. Wiring Methods: Install all fire alarm wiring in metal conduit, minimum 3/4-inch, in accordance with Section 260533, “Raceways and Boxes for Electrical Systems” and manufacturer’s recommendations. Conceal raceway, except in unfinished spaces.
1. Install plenum rated cable, in conduit, in environmental air spaces, including plenum ceilings.

B. Provide red finish for fire alarm raceways in assessable areas above ceilings, and exposed unfinished spaces. Match adjacent architectural finish for exposed fire alarm raceways in finished areas with red junction box covers.

C. All junction box covers shall be painted red on both sides to designate use for Fire Alarm conductors. The interior of junction boxes shall not be painted.

D. Where allowed, surface boxes shall be as manufactured by the device manufacturer for the installed device and shall match devices in size.

E. There shall be no splices in the system other than at device terminal blocks, or on terminal blocks in cabinets. "Wire nuts" and crimp splices will not be permitted. All terminal block screws shall have pressure wire connectors of the self-lifting or box lug type.

F. For underground raceways and other wet locations, provide moisture resistant PLTC cable.

G. All fire alarm and communications circuits that extend beyond the building footprint and are run outdoors shall be provided with a surge protective device.

H. All circuits leaving the riser on each floor or building zone shall feed through a labeled terminal block in a terminal cabinet accessible from the floor.

I. T-Taps are not permitted for Class B circuits. Locate end of branch devices in a readily accessible location.

3.4 CONNECTIONS

A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.

1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.

B. Coordinate connections to electronic access-controlled doors with door hardware specifications and actual door hardware. Provide all connections for release of locking mechanisms in egress paths as required.

C. Verify exact connection requirements to all equipment and devices of other trades with those trades prior to ordering equipment.

D. Make addressable connections with a supervised interface device to controlled or monitored devices and systems. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

3.5 IDENTIFICATION

A. Comply with Section 270553, “Identification for Communications Systems”

1. Identify system components, wiring, cabling, and terminals. Identify all fire alarm circuits at terminal and junction locations.
2. Install a nameplate on each fire alarm panel and power supply to indicate the equipment designation, panelboard and circuit number supplying the fire alarm equipment.
3. Branch circuit overcurrent protective devices powering fire alarm equipment shall be identified as FIRE ALARM CIRCUIT with a red and white engraved label permanently affixed to the equipment.
4. Provide engraved label for each remote alarm indicator.
5. Label all addressable control modules to identify their function.

B. Basic operating instructions shall be framed and permanently mounted at the FACP. (If the owner concurs, they may instead be affixed to the inside of the FACP's door.) In addition, the NFPA 72 "Record of Completion" must either be kept at the FACP, or its location shall be permanently indicated there by an engraved label. All System documentation shall be provided and housed in a Documentation Cabinet at the control panel or other approved location in accordance with NFPA 72.

3.6 GROUNDING

A. Ground FACP and surge protective devices for associated circuits in accordance with Section 260526, “Grounding and Bonding for Electrical Systems”.

B. Ground shielded cables at control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

A. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

B. Coordinate all testing in occupied buildings with the owner’s representative to minimize the disturbance to the building occupants.

C. Visual Inspections: Conduct prior to testing.

1. Inspection must be based on completed record Drawings and system documentation that is required by "Completion Documents, Preparation" table in "Documentation" section of "Fundamentals" chapter in NFPA 72.
2. Comply with "Visual Inspection Frequencies" table in "Inspection" section of "Inspection, Testing and Maintenance" chapter in NFPA 72; retain "Initial/Reacceptance" column and list only installed components.

D. Preliminary Testing

1. Check all wiring for grounds, opens, and shorts, prior to termination at panels and installation of detector heads. The minimum resistance to ground or between any two conductors shall be 10 megohms, as verified with an insulation tester.
2. Ensure all devices and circuits are functioning properly in accordance with manufacturer’s requirements.

E. System Acceptance Testing: Comply with "Test Methods" table in "Testing" section of "Inspection, Testing and Maintenance" chapter in NFPA 72.

1. Test audible appliances for public operating mode in accordance with manufacturer's written instructions. Perform test using portable sound-level meter complying with Type 2 requirements in ASA S1.4 Part 1/IEC 61672-1.
2. Verify candela settings and test visible appliances for public operating mode in accordance with manufacturer's written instructions.
3. Test all site-specific software functions and provide a detailed report showing the system’s operational matrix. Each initiating device shall activate the proper response and system notification.
4. Verify all other system functions, including (where applicable) elevator capture and the control of HVAC systems, door locks, pressurization fans, fire, or smoke doors/dampers/shutters, etc.

5. Verify digital communicators are on-line and tested for proper communication to the receiving station.
6. All supervised circuits must also be tested to verify proper supervision.
7. Verify the voltage drop of each NAC circuit by testing and recording the voltage at the origin and at the EOL for each NAC circuit, under battery power only.

F. Reacceptance Testing: Perform reacceptance testing to verify proper operation of added or replaced devices and appliances, software modification, or wiring modifications. Such re-testing shall be included as part of the base bid and provided at no additional cost to the Owner.

G. Final Acceptance Test: Complete record drawings and system operation matrix are required prior to scheduling final acceptance test.
1. The owner’s representative, monitoring service, and fire department shall be notified before final tests in accordance with local requirements.
2. Operate every device to verify proper operation and correct annunciation.
3. Open signaling line circuits and notification appliance circuits in at least two locations to verify proper supervision.

H. Fire-alarm system will be considered defective if it does not pass tests and inspections.

I. Factory-authorized service representative must prepare "Fire Alarm System Record of Completion" in "Documentation" section of "Fundamentals" chapter in NFPA 72 and "Inspection and Testing Form" in "Records" section of "Inspection, Testing and Maintenance" chapter in NFPA 72. Submit certified results to the AHJ, Owner, Architect, and Engineer.

J. Prepare test and inspection reports.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

B. The manufacturer's authorized representative must instruct the owner's designated employees in operation of the system, and in all required periodic maintenance. A minimum of 8 hours on-site time will be allocated for this purpose. Two copies of a written, bound summary will be provided, for future reference.

C. Training shall cover as minimum the following topics:
1. Preventive maintenance service techniques and schedules, including historical data trending of alarm and trouble records.
2. Overall system concepts, capabilities, and functions. Training shall be in depth, so that the owner shall be able to take any device out of service and return any device to service without need of Manufacturer’s approval or assistance.
3. Explanation of all control functions, including training to program and operate the system software.
4. Methods and means of troubleshooting and replacement of all field wiring devices.
5. Methods and procedures for troubleshooting the main fire alarm control panel, including field peripheral devices as to programming, bussing systems, internal panel and unit wiring, circuitry, and interconnections.
6. Manuals, drawings, and technical documentation. Actual system software used for training shall be provided in digital form and shall be left with the Owner at the completion of training for the Owner’s use in the future.

D. A receipt shall be obtained from the Owner that this has been accomplished, and a copy included in the close-out documents.

END OF ADDRESSABLE FIRE ALARM SYSTEMS

SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work generally includes, but not by way of limitation, the following:
   1. The extent of earthwork is shown on drawings.
   2. Engineered fill for building support.
   3. Preparation of subgrade for foundations and slab-on-grade.
   4. Backfilling of trenches for utilities and services.
   5. Excavation and backfilling for building.
   6. Cut and fill of project site.
   7. Computer generated cut and fill calculations.
   8. Subgrade shall be graded to drain during the entire construction period.
   9. Geotextile fabric to act for soil stabilization, soil separation, weed barrier, or moisture barrier in a variety of earthwork, sitework or landscape applications.

B. Contractor is responsible for implementing any proper means and methods necessary to complete work of this section based on normal seasonal environmental conditions.

C. No additional compensation will be considered for contractor's assumption that work would be completed under ideal environmental conditions.

D. Unless otherwise allowed by the Architect, it shall be assumed that all excavated rock shall be removed from the site and disposed of by the Contractor.

E. Unless otherwise directed by the Architect, it shall be assumed that all needed materials shall be brought in from offsite and supplied and installed by the Contractor.

F. Unless otherwise directed by the Architect, it shall be assumed that all excess materials shall be removed from the site and hauled off and disposed of offsite by the Contractor.

1.02 QUALITY ASSURANCE

A. Codes and Standards:
   1. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

B. Testing and Inspection Service:
   1. Contractor will provide a Soils Engineer, as acceptable to the Architect, for testing and inspection service for quality control testing during all earthwork operation.
   2. See Section 01 45 00 - Quality Control.
   3. If not already covered by another Section of these Specifications, submit Soils Engineer's credentials for acceptance.

C. Soils Engineer representative must be present to observe and perform tests at all times any soil work or earthwork activities are in progress:
   1. Determine suitability of materials for compacted fill, backfill and engineered fill.
   2. Determine preparation and placing of materials for fill, backfill and engineered fill.
   3. Determine maximum density of optimum moisture content for placing and compacting materials.
   4. Perform necessary field density tests to insure adequate compaction for fill, backfill and engineered fill, for each compacted layer of fill.
   5. Perform necessary field inspection of different phases of earthwork.

6. Perform necessary field inspection for borrow pits.

D. Surveyor shall verify property lines, right-of-way; establish correct levels, lines and grades; completely layout work required.

1.03 SUBMITTALS

A. Written copy of test reports of all tests to the Architect within 48 hours.

1.04 SITE CONDITIONS

A. Site Information:
   1. Data on indicated subsurface conditions are not intended as representations of warranties of accuracy of continuity between soil borings.
   2. It is expressly understood that neither the Owner nor its consultants will be responsible for interpretations or conclusions drawn by the Contractor. Data is made available solely for convenience of Contractor.
   3. Additional test boring and other exploratory operations may be made by Contractor at no cost to the Owner.

B. Existing Utilities:
   1. Locate existing under ground utilities in areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
   2. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions and notify Architect. Cooperate with the Owner and utility companies in keeping respective services and facilities in operation.
   3. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
   4. Demolish and completely remove from Owner's property existing under ground utilities indicated to be removed or required to be removed for completion of the Work. Coordinate with utility companies for shut-off services if lines are active.

C. Explosives:
   1. Explosives will not be permitted.

D. Cut and Fill Material Quantities:
   1. It is expressly understood that neither the Owner, Architect or their consultants will be responsible for quantities of cut or fill required to achieve the final grades indicated on the drawings.
   2. Neither the Owner, Architect or their consultants will be responsible for the type of material existing on the site or its quality for use as a particular type of fill.
   3. The contractor is responsible for reviewing existing conditions and proposed design in detail as he determines sufficient for calculating the extent of the work and materials required.
   4. Contractor will be allowed to dig test holes during bidding. A minimum of 24 hours notice to owner of the anticipated locations and depths will be required.
   5. Contractor shall not assume a "balanced" project of cut and fill quantities.

E. The Contractor shall consider the timing required for all earthwork for the entire project. He shall include in his bid all work and costs associated with the proper protection, procedures and materials required for the weather and environmental conditions for the time of year the work is to occur. No additional costs will be borne by the Owner, Architect or their consultants for failure by the Contractor to include these costs in the bid.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Fill:
1. Earth, free of vegetation, waste, humus, rocks, boulders, stones, bricks, batts, plaster, mortar or other debris.
2. Broken concrete, block or brick shall not be used for fill.
3. Rocks larger than 3 inches in any dimension shall not be used within subgrade.
4. Plasticity index (PI) less than 35.
5. Maximum dry density according to the Standard Proctor Compaction Test, minimum 100 pcf. Modified Proctor Compaction Test may be performed in lieu of Standard Proctor Compaction Test.

B. Mass Backfill:
1. Suitable earth removed from the excavation, free of rocks, boulders, stones larger than 2 inches or other building materials debris.
2. Brown sandy clays may be used for backfill around exterior of foundations.
3. Topsoil and soil containing decomposed organic materials shall be considered suitable for topsoil fill material only.
4. Aeration of some backfill may be required for compaction.
5. Plasticity index (PI) less than 35.
6. Maximum dry density according to the standard Proctor compaction test, minimum 100 pcf. Modified Proctor Compaction Test may be performed in lieu of Standard Proctor Compaction Test.

C. Trench Backfill:
1. Sand for all typical locations.
2. Onsite soil may be used for fill from 12 inches above pipes in grassy areas in lieu of sand. Intent is to not have sand or gravel bedding stone visible at the top of the excavation in grassy areas.

D. Engineered Fill:
1. Cohesive and stable earth as described above, suitable for bearing.

E. Drainage Fill / Granular Fill:
1. Washed, evenly graded mixture of crushed stone, crushed gravel, uncrushed gravel or river gravel.
2. Contain maximum 5% by weights, passing No. 8 sieve, 100% passing 1 inch sieve.
3. Sand will not be an acceptable drainage fill/granular fill material.

F. Top Soil:
1. Natural, fertile, agricultural soil, capable of sustaining vigorous plant and lawn growth.
2. Uniform composition throughout, without admixture of subsoil.
3. Free of stones, lumps, clods, sod, live plants and their roots, sticks and other extraneous matter.

2.02 GEOTEXTILE FABRIC

A. Equal to: “Propex GeoSynthetics”, Geotex 200ST.

B. Description:
1. Woven slit film geotextile fabric.

2. Individual films shall be woven together to provide dimensional stability relative to each other.
3. Resistant to ultraviolet degradation and to biological and chemical environments normally present in soils and subsurface conditions.

C. Quality Control and Performance Standards:

1.	Tensile Strength:	200 lbs (ASTM D-4632).
2.	Elongation:	12% (ASTM D-4632).
3.	Puncture:	90 lbs. (ASTM D-4833).
4.	CBR Puncture:	700 lbs. (ASTM D-6241).
5.	Mullen Burst:	400 psi (ASTM D-3786).
6.	Trapezoidal Tear:	75 lbs. (ASTM D-4533).
7.	UV Resistance:	70% retained at 500 hrs (ASTM D-4355).
8.	Apparent Opening Size:	40 US Standard Sieve (ASTM D-4751).
9.	Permittivity:	.05 sec (ASTM D-4491).
10.	Water Flow Rate:	4 gpm/ft2 (ASTM D-4491).

PART 3 - EXECUTION

3.01 INSPECTION

A. Contractor shall thoroughly review the existing conditions, prior to bidding or starting earthwork. This includes topography, soil materials, site access, etc. and the schedule requirements to complete the work of this section without delaying other trades or the overall project schedule.

B. Review conditions of property adjacent to the site. Do not alter storm drainage, access, utilities etc. to the adjacent property without prior approval of Architect and Owner.

3.02 PROTECTION

A. Maintain excavation banks and pit walls in a safe and stable conditions.

B. Provide sheet piling, shoring and bracing as necessary to maintain excavation banks and pits, and for the protection of adjoining property, structures, pits and footings.

C. Keep open excavation free of water, both surface and subterranean by use of pumps and earth damming around such excavations to throw surface water away from the excavation of any structure.

D. Protect open excavation by lighted barricades or railings to prevent injury to personnel.

E. Protect existing utilities, roads, pavement and structures.

3.03 PREPARATION

A. Clearing:
1. Clear areas as specified in Section 31 10 00.
2. Remove topsoil to its full depth at construction and within grading limits.
3. Stock topsoil for use in finish grading operation. Do not use for fill.

B. Provide grade stakes; maintain lines and grades. Stakes no more than 25 ft. apart along roadways, and 50 ft. maximum along drives and paved areas.

C. Disk to depth of 6 inches below subgrade and compact to required density prior to proof-rolling.

D. Proofroll stripped subgrade with rubber tired roller or other means approved by Architect.

E. Clean out unsuitable pockets and fill with earth fill, compacted.

F. Disc or blade subgrade until uniform, and compact to specified density.

G. Do not place fill materials until subgrade excavation has been inspected and approved by Soils Engineer and Architect.

3.04 EXCAVATION

A. Excavate true to line and grade, level at bottom.

B. Excavate to suitable bearing subsoil as determined by Soils Engineer.

C. Excavations shall be to the dimensions indicated plus sufficient space to permit erection of forms, shoring, masonry, and foundations and excavation inspections.

D. Excavation below slabs and paving shall be sufficient to permit placement of subbase materials.

E. Foundations:
1. If suitable bearing is not encountered at the depth indicated on drawings for foundations, immediately notify the Architect.
2. Do not proceed further until instructions are given by the Architect and required tests are completed.
3. Under no conditions are footings to be placed on soft earth or fill.

F. Footing Trenches:
1. Where soil conditions permit, footing trenches may be excavated to the exact dimension of the concrete, and side forms omitted.
2. Place footings and foundations upon undisturbed, firm bottoms.
3. Fill with lean concrete any excess cut under footings and foundations.

G. Provide shoring or piling as required to protect excavation banks.

3.05 ROCK EXCAVATION

A. Definition:
1. Rock is defined as stone or hard shale in original ledge, boulders over 1/2 cu. yard in volume, masonry or concrete that cannot be broken and removed by normal job equipment (power shovel 1/2 yard capacity, scoops, bulldozers), without the use of explosives or drills.
2. This classification does not include material such as loose rock, concrete or other materials that can be removed by means other than drilling and blasting.
3. Boulders shall be removed from excavation and stockpiled for removal from site.

B. Measurement:
1. Rock shall be stripped for measurement before excavating, and no rock excavated or loosened before measurement will be allowed or paid for as rock.
2. Measurement and payment, shall be by the number of cubic yards required to bring excavation to required surface of grade shown on drawings.
3. Owner may adjust grades should excessive rock be encountered.

C. Rock Excavation Space Allowance:
1. 18 inches outside wall lines of building, or outside of concrete work for which forms are required.
2. 4 inches below and 12 inches each side of underground pipes.

3. Outside dimensions of concrete work for which no forms are required.

D. Payment:
1. No additional compensation will be made for rock removal identified in the Geotechnical Report, using a reasonable straight interpolation of the rock elevation between borings. For purposes of rock removal, "refusal" in the boring logs is assumed to be rock.
2. Geotechnical Report indicates rock will be encountered during construction.
3. Contractor shall include in the Lump Sum Base Bid or applicable Alternate Bids, the cost of rock removal required for completion of this work throughout the entire site, based upon the Geotechnical Report.
4. Bidders may visit the site and make additional underground investigations at their discretion. Coordinate schedule and locations with Architect at least 24 hours in advance.
5. For rock encountered that could not have been reasonably foreseen based upon the Geotechnical Report, do not proceed without written permission from the Architect. If approved, payment will be made upon a unit price basis, or upon a time and material basis, whichever is less.
6. Contractor shall submit timesheets, material records and receipts, and any other supportive data requested by the Architect for determination of final approved price.

E. Explosives:
1. Explosives will not be permitted.

3.06 FILLING AND BACKFILLING

A. Fills shall be formed of satisfactory materials placed in successive horizontal layers of approximately 6 inches in loose depth for the full width of the cross section.

B. Proof roll all areas to receive fill.

C. Where objectionable subgrade material is encountered and removed, fill excavated area to original ground level with suitable fill as specified, and compacted as required before starting filling operation.

D. All material entering the fill shall be free of organic matter such as leaves, grass, roots and other objectionable material.

E. Sprinkling:
1. Use sprinkling wagons, pressure distributors and other approved equipment that will sufficiently distribute the water.
2. Sufficient equipment to furnish the required water shall be available at all times.

F. Take samples at frequent intervals of all fill materials for testing, both before and after placement and compaction. From these tests, corrections, adjustments and modifications of methods, materials and moisture content will be made to construct the fill.

G. Construction of filled areas:
1. Starting layers shall be placed in the deepest portion of the fill.
2. Each lift shall be disked or treated by some other mechanical means as to insure the breaking up of any existing lumps and clods.
3. As placement progresses, layers shall be constructed approximately parallel to the finished grade line.

H. The Contractor shall be responsible for the stability of fills made under the contract and shall replace any portion which has become displaced due to carelessness or negligence on the part of the Contractor.

I. Heavy equipment for spreading fill shall not be used closer to structures that a distance equal to the height of backfill above top of footing.

J. Backfilling shall not be done until walls are braced or shored.

K. If fill is to be provided on both sides of walls, fill on both sides at same time.

L. Drainage fill under floor slabs on grade shall be placed to indicated depths not less than 4 inches.

M. Fill excess cuts under slabs with drainage fill and thoroughly compact.

N. Dispose of all excess fill offsite.

O. Provide acceptable fill from off site if necessary to meet finish grades indicated, at no additional cost to Owner.

3.07 COMPACTION

A. Fill areas shall be compacted using equipment capable of compacting each lift its full depth. Moisture during compaction operations shall be maintained at optimum content.

B. Compacting equipment shall be approved equipment of such design, weight and quantity to obtain the required density in accordance with soil compaction specification.

C. Add moisture or aerate material as necessary to achieve optimum moisture content.

D. Compaction operations shall be continued until the fill is compacted to not less than the following percent of the maximum dry density as determined in accordance with ASTM D698.
1. 100% in fill areas supporting footings.
2. 95% in non-load bearing areas within building lines.
3. 95% in fill areas under paved areas.
4. 85% in landscaped areas.

E. Any areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers.

F. Operate equipment so that hardpan, cemented gravel, clay, or other chunky soil material will be broken up into small particles and become incorporated with the material in the layer.

G. Cut areas: Disk to 6 inches below subgrade and compact to 95% of maximum dry density at optimum moisture content as determined by Standard Proctor ASTM D698.

H. Compaction by flooding is not acceptable.

I. Sealing: At end of each work day of filling and compaction operation, roll surface with smooth tired vehicle to leave smooth surfaced sealed to shed all water.

3.08 GRADING

A. Furnish, operate and maintain such equipment as is necessary to control uniform layers, sections and smoothness of grade for maximum compaction and drainage.

B. Rough Grading:

1. Even grade to elevations 6 inches below finish grade topsoil elevations indicated.
2. Protect all constructed items during grading operations, and repair if damaged.
3. All areas in the project including excavated and filled sections and adjacent transition areas shall be reasonably smooth, compacted and free from irregular surface changes.
4. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified.
5. The finished subgrade surface generally shall be not more than 0.10 feet above or below the established grade or approved cross-section, with due allowance for topsoil and sod where required.
6. The tolerance for areas within 120 feet of the buildings shall not exceed 0.10 feet above or below the established subgrade.
7. All ditches, swales and gutters shall be finished to drain readily.
8. Unless otherwise indicated on the drawings, the subgrade shall be evenly sloped to provide drainage away from the building walls in all directions at a grade not less than 1/2 inch per foot.
9. Provide roundings at top and bottom of banks and at other breaks in grade.

C. Protection:
1. Protect newly graded areas from the action of the elements.
2. Any settlement or washing that occur prior to acceptance of the work shall be repaired, and grades re-established to the required elevations and slopes.
3. Fill to required subgrade levels any areas where settlement occurs.

D. Finish Grading:
1. Proceed to finish elevations indicated.
2. Rake subsoil clean of stones and debris. Scarify to depth of 3 inches.
3. Spread stockpile topsoil over prepared subgrade to minimum depth of 6 inches, and rolled until suitable for seeding.
4. Maintain surfaces and replace additional topsoil necessary to repair erosion.

E. Continued Drainage:
1. All subgrade shall be graded to continuously drain during all phases and entire duration of construction and construction activities.
2. Contractor shall be held responsible for any/all detrimental site, soil and subsurface conditions created or altered as a result of improper drainage of soils and subgrade.

3.09 QUALITY CONTROL

A. Tests of Earthwork for Paved Areas and Slabs on Grade:
1. An average of one test per 6 inch lift of each 5,000 square feet area will be required.
2. The exact number of tests will depend on the weather, and be at the discretion of the Soil Engineer and approved by the Architect.
3. Testing firms shall test and approve all material use in fill operation.
4. Should tests indicate the required density was not attained, Contractor shall remove fill and/or backfill to depths required and as determined by the test and repeat operations until said density is attained.

B. Quality Control of Footings:
1. Footing excavation bases will be inspected by Soils Engineer.
2. If soft pockets are encountered, the undesirable material shall be removed.

C. The Architect upon the recommendation of the Testing Laboratory, will have the power of rejection of materials, equipment or operating procedures which are not suitable to produce the results specified.

D. The Contractor shall cooperate with the Testing Laboratory and shall allow the Soils Engineer ample

time to conduct tests. Operation of equipment shall be discontinued when the operation interferes with testing.

SUBMITTAL CHECK LIST

1. Qualifications of Soils Engineer.
2. Test results and reports of Soils Engineer/Testing Laboratory.

END OF SECTION 31 00 00

SECTION 31 10 00 - SITE CLEARING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to clear the site prior to excavation operation.

B. Extent of site clearing is shown on drawings and/or included herein. Includes, but is not limited to:
1. General requirements and preparation.
2. Clearing and grubbing.
3. Temporary erosion and sedimentary control measures.
4. Topsoil stripping and stockpiling.
5. Tree removal and protection.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Equipment used for clearing and grubbing operation shall be the contractor's option.

2.02 SOIL MATERIALS

A. Obtain all borrow materials from off-site when unsatisfactory quality or insufficient quantity of soil materials are not available on-site.

PART 3 - EXECUTION

3.01 GENERAL

A. All debris will be removed from the Owner’s property immediately. Burning on the site will be not be permitted. Care shall be taken to keep the nuisance of trash, noise and dust at a minimum.

B. Protect existing site improvements to remain from damage during construction activities.

C. Damage inflicted to any/all areas which are not to receive work, shall be repaired, or replaced by the Contractor as required by the Owner and Architect/Engineer.

D. Do not close or obstruct streets, sidewalks, drives, or other adjacent occupied facilities without permission and approval of the Owner, Architect/Engineer, and Legal Authorities. Do not allow parking or storage of equipment or materials in existing parking areas. Provide alternates routes around closed or obstructed traffic ways, as approved by the Owner, Architect/Engineer, and Legal Authorities.

E. When trees are shown to be removed, it shall mean grub out stumps and remove from property. Trees to be removed are indicated on the Drawings.

3.02 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Notify utility locator service for the area of the project before commencing any site clearing work. Arrange with utilities for proper shut-off of any utility operations and services as required.

C. Do not commence any site clearing work until temporary erosion and sedimentary controls measures are in place.

D. Locate and clearly mark all trees and vegetation which is to remain, be relocated, or removed.

3.03 CLEARING AND GRUBBING

A. Clear the project sites of cinders, fill debris, concrete slabs, curbs, and retaining walls, bituminous and aggregate pavements, compacted aggregate bases, sidewalks, curbs, drainage structures and utility distribution system as required or indicated on the Drawings, including those shown on Mechanical and Electrical Drawings.

B. Clearing shall consist of the removal and disposal of all encumbrance to a depth of at least twenty-four inches below finished earthwork grades or pavement subgrades, whichever is used in the area under construction.

C. No foundation walls, footings, walks or slabs remaining from any former construction are to be used for new construction. Remove all existing walks, slabs, walls, footing, foundations, and other construction encountered within the property lines to their full depth.

D. Grubbing shall consist of the removal of sod, trees, weeds and other vegetation, stones and rocks within various work areas.

E. Rubbish deposits, if encountered, shall be removed to their full depth under areas that are to be paved or have structures on them. Replace deposits with concrete, No. 73B crushed stone or earth borrow compacted as specified in other sections of the Specifications.

F. Fill depressions caused by clearing and grubbing activities with satisfactory soil material unless further excavation or earthwork is indicated.

3.04 TEMPORARY EROSION AND SEDIMENTARY CONTROL MEASURES

A. Provide temporary erosion and sedimentary control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, in accordance with the agencies and authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentary control measures during construction until permanent vegetation has been properly established.

C. Remove erosion and sedimentary control measures and restore and stabilize areas disturbed during removal.

3.05 TOPSOIL STRIPPING AND STOCKPILING

A. Areas to be stripped shall first be scraped clean of all brush, weeds, sod, grass, roots, and other materials that will interfere with lawn maintenance, prior to stripping of topsoil.

B. Topsoil shall be kept reasonably free from subsoil, debris and stones larger than 2 inches in diameter.

C. Remove topsoil, to its entire depth, from the areas within lines 4 feet outside of foundation walls of buildings, from areas to be occupied by roads and asphalt paving areas. Areas to be regraded or subject to compaction by construction traffic shall have topsoil removed to a depth of 6 inches.

D. Stored topsoil shall be stockpiled on-site to be used for finished grading. Locate stockpiled topsoil in designated or approved locations where it will not interfere with building or utility operations.

E. Cover stockpiled topsoil to prevent windblown dust. Temporarily seed as required for erosion and

sedimentary control.

3.06 TREE REMOVAL

A. Remove all trees and stumps from area to be occupied by new buildings, roads, and surfaced areas. Removal of trees outside these areas shall only be done as noted on drawings and approved by the Architect.

B. All brush, stumps, wood and other refuse from the trees shall be removed by digging, including the roots.

3.07 TREE PROTECTION

A. The contractor shall be responsible for the protection of tops, trunks and roots of existing trees on project site that are to remain.

B. Existing trees subject to construction damage shall be fenced to the limits of their branch spread or otherwise protected before any work is started; remove fencing when complete. Remove interfering branches without injury to trunks and cover scars with tree paint. Do not permit heavy equipment or stockpiles within branch spread.

C. In general, do not excavate within the tree protection zone or within the branch spread of trees. Where excavating, fill or grading is required within the branch spread of trees that are to remain, the work shall be performed as follows:

1. Trenching: When trenching occurs around trees to remain, the tree roots shall be tunneled under or around the roots by careful hand digging and without injury to the roots.

END OF SECTION 31 10 00

SECTION 31 25 00 - EROSION CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install erosion control materials and procedures as required to hold silt on site.

B. Maintain the erosion control systems and procedures throughout the project, including corrections of any and all measures following rain, storms or other inclement weather.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Quick Growing Grasses:
   1. Wheat, rye or oats.
   2. Integrally seeded stabilization mats.

B. Straw Bales:
   1. Free of weed seed.
   2. 2 inch x 2 inch x 48 inch wood stakes.

C. Silt Fence:
   1. Geotextile fabric and staking system.

D. Rock Check Dam:
   1. Crushed limestone.

E. Engineered Fill:
   1. Cohesive and stable earth as described above, suitable for bearing.

F. Temporary Mulch:
   1. Loose straw crimped into soil.

PART 3 - EXECUTION

3.01 INSPECTION

A. Thoroughly review existing site conditions prior to bidding or starting earthwork.

B. Review conditions of property adjacent to the site. Do not alter storm drainage, access, utilities etc. to the adjacent property without prior approval of Architect and Owner.

3.02 IMPLEMENTATION

A. Maintain excavation banks and pit walls in a safe and stable condition.

B. Maintain temporary erosion control systems installed to control siltation at all times throughout the work.

C. Install permanent erosion control measures as soon as possible.

D. Protect open excavation by lighted barricades or railings to prevent injury to personnel.

END OF SECTION 31 25 00

SECTION 31 31 16 - TERMITE CONTROL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to provide termite treatment as specified herein.

1.02 QUALITY ASSURANCE

A. Applicators Qualifications:
   1. Performed by applicator licensed in the State of application.
   2. Minimum three (3) year's experience.

1.03 SUBMITTALS

A. Manufacturer's Literature.
   1. Published data on product solution composition and use.
   2. Mixing and application instructions.
   3. Material Safety and Data Sheets (MSDS).

B. Written warranty and guarantee.

1.04 WARRANTY

A. Provide written warranty and insured guarantee.

B. Effectiveness of treatment guaranteed for not less than five (5) years.

C. If any termite activity is discovered within the warranty period, the Contractor shall re-treat structure and repair or replace all areas of damage caused, without any expense to the Owner.

D. Guarantee to prevent and control infestations by subterranean termite species of genera:
   1. Coptotermes.
   2. Heterotermes.
   3. Reticulitermes.
   4. Zootermopsis.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Provide one of the following approved products:
   1. "FMC Corporation"; Prevail FT.
   2. "FMC Corporation"; Talstar P.
   3. "FMC Corporation"; Baseline Pretreat Termiticide.
   4. "Masterline"; Bifenthrin 7.9.
   5. "Nisus Corporation"; Bora-Care.

B. Description:
   1. Termiticide, insecticide, fungicide.
   2. Water-based or borate-based chemical emulsion.
   3. Safe for use on wood, concrete, plastics, metals, flashings, rigid insulations, and earth.
   4. Shall provide a continuous barrier that termites cannot cross and eliminate wood as a food source.

PART 3 - EXECUTION

3.01 APPLICATION

A. Areas of Treatment:
   1. Treat entire under-slab area of building a minimum of two inches beyond the exterior building line.
   2. Treat entire interior surface of all foundation walls, grade beams, crawlspaces and basement walls.
   3. Treat all areas of building expansion joints and both sides of planned interior partitions.
   4. Treat all pipe, conduit and plumbing penetrations through the exterior walls.
   5. Treat all pipe, conduit and plumbing penetrations through the floor slab.

B. Rate of Application:
   1. Apply treatment in strict accordance with the manufacturer's published rates of application.
   2. Vary rates of application at each condition of use as per the manufacturer.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Written warranty and guarantee.

END OF SECTION 31 31 16

SECTION 32 12 16 - ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete the asphalt concrete paving work indicated, noted, and detailed on the drawings and specified herein.

1.02 QUALITY ASSURANCE

A. Provide final surface of uniform texture conforming to required grades and cross sections.

B. Surface smoothness, when tested with 10 ft. Straight-edge:
   1. Base: 1/4 inch in 10 ft. maximum.
   2. Binder Course: 1/4 inch in 10 ft. maximum.
   3. Surface Course: 1/8 inch in 10 ft. maximum.

1.03 REFERENCES

A. Publications of the following institutes, associations, societies, and agencies are referred to this Section.
   1. Indiana Department of Highways, Standards Specifications, Latest Edition, IDH.
   2. American Society for Testing and Materials, ASTM.

1.04 SUBMITTALS

A. Prior to starting any asphalt concrete paving work, prepare a preliminary Job-Mix formula for all asphalt paving to be used in this project.
   1. Submit preliminary Job-Mix formula to the Architect for review a minimum of 15 days before asphalt concrete paving is required.

1.05 SITE CONDITIONS

A. Ambient Air Temperature (Degrees Fahrenheit).
   1. Base/Binder Course - 35°F minimum.
   2. Surface Course - 45°F minimum.
   3. Marking Paint - 40°F - 95°F.

B. No binder course or surface course shall be applied to wet surfaces.
   Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure.

C. Lane marking paint shall only be applied to clean, dry surfaces.

D. Surface course shall NOT be applied after October 15 or before May 1.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   1. Use locally available materials and gradations which exhibit a satisfactory record of previous installations.

B. Dense Graded Aggregate (DGA):
   1. Graded aggregate and water mixed.
   2. Meet requirements of IDH Standard Specification, Section 303.

C. Course Aggregate:
1. Sound, angular crushed stone, crushed gravel, or cured crushed blast-furnace slag.
2. ASTM D692.
3. Meet requirements of IDH Standard Specification, Section 903.02.

D. Fine Aggregate:
1. Sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
2. ASTM D1073.
3. Meet requirement of IDH Standard Specification; Section 903.01.

E. Asphalt Cement:
1. Prepared by the refining of petroleum.
2. Viscosity grade: PG 64-22.
3. AASHTO M 320 or AASHTO MP 1a.
4. Meet requirements of IDH Standard Specification, Section 902.01.

F. Lane Marking Paint:
1. Equal to:
   a. "MPI"; #32 Alkyd Traffic Marking Paint.
   b. "MPI"; #97 Latex Traffic Marking Paint (only where alkyd paints are not permitted).
2. Factory Mixed, quick drying and non-bleeding alkyd oil based paint.
3. FS TT-P-115, Type III.
4. Color:
   a. White (typical striping locations).
   b. Yellow (where indicated on Drawings).
   c. ADA blue at all handicap spaces and access aisles.

2.02 TABLE OF COMPOSITION LIMITS

Sieve Size	Metric Size	Percent Passing by Weight	
		Binder	Surface
1 inch	25.0 mm	100	100
3/4 inch	19.0 mm	90 - 95	100
1/2 inch	12.5 mm	70 - 92	100
3/8 inch	9.50 mm	50 - 76	85 - 95
No. 4	4.75 mm	35 - 40	55 - 70
No. 8	2.36 mm	18 - 45	30 - 65
No. 16	1.18 mm	10 - 36	15 - 50
No. 30	600 μm	6 - 26	8 - 40
No. 50	300 μm	2 - 18	3 - 25
No. 100	150 μm	0 - 11	0 - 15
No. 200	75 μm	0 - 5	0 - 4
Asphalt Content		4.0 - 6.0	4.5 - 6.5
Course Aggregate Size		No. 8 & 11	No. 11
Fine Aggregate		L.S. Sand	Sand

PART 3 - EXECUTION

3.01 GENERAL

A. Subgrade shall be proof-rolled using pneumatic tired roller capable of exerting minimum 90 psi pressure uniformly over the subgrade surface.
   1. Proof-rolling shall provide two complete coverages.
   2. Remove and replace soft spots with stable material, compact and re-proof.
   3. Do not proof-roll wet or saturated surfaces.

B. Proceed with paving only after all unsatisfactory subsurface conditions have been corrected.

C. All materials shall be spread using approved spreading equipment. Tailgating of aggregates directly onto subgrades will not be acceptable.
   1. Asphalt pavers shall be self-propelled with receiving hopper of sufficient capacity to provide a uniform spreading operation.
   2. Rollers shall be steel wheeled weighing 10 ton or three wheeled rollers with bearing of 300 pounds per linear inch width of rear wheels.

D. Contractor shall have on hand at the site prior to paving operation all necessary portable and hand tools and one stand-by roller.

3.02 COMPACTION

A. Subgrade and compacted base courses shall be compacted to 95% of maximum dry density in accordance with ASTM D698.
   1. Each lift of aggregate base shall be compacted to density specified above.
   2. Soft spots found during proof-rolling which are replaced with fill material shall be compacted to density specified above.

3.03 SURFACE PREPARATION

A. Remove loose material from base surface immediately before applying prime coat.

3.04 SPREADING AND ROLLING

A. Base Course, Compacted Stone Aggregates, and DGA:
   1. Spread and compact in separate lifts, maximum 4 inches each, see details for depths.
   2. Extend lower lift 4 inches beyond next lift.

B. Binder Course:
   1. Spread and roll to minimum finish depths indicate on details.
   2. Spread mixture at minimum temperature of 250°F.

C. Surface Course:
   1. Spread and roll to minimum finish depths indicated on details.
   2. Finish installation shall be true to line and grade and within 1/2 inches of true elevation.

3.05 STRIPING PAINT

A. Cleaning: Sweep and clean surface to eliminate loose materials and dust.

B. Striping: Use alkyd-oil traffic lane-marking paint, factory-mixed, quick-drying, and non-bleeding.

C. Apply paint with mechanical equipment to produce uniform straight edges.
Apply in 2 coats at manufacturer’s recommended rates to form 4 inches minimum width lines.

D. Handicap parking spaces shall be white symbol on an ADA Blue background.

3.06 DENSITY TESTS

A. Take density tests at each lift as directed by the Architect.

B. Tests shall be made by a soils engineer approved by the Architect.
   1. A total of at least four (4) tests will be required at various times and locations for subgrade and base course for paved areas.
   2. Provide results of each test to the Architect within 72 hours after tests are made.
   3. Include cost of tests as outlined above in the contract amount.

SUBMITTAL CHECK LIST

1. Asphalt Paving Mix Formula.
2. Density Test Results.

END OF SECTION 32 12 16

SECTION 32 16 00 - CONCRETE PAVING AND CURBS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, material, equipment, special tools, supervision and services required to deliver and place all cast-in-place site concrete indicated, noted and detailed on the drawings and specified herein.

B. Types of work in this section includes, but not limited to the following:
1. Concrete drives and aprons.
2. Concrete walks.
3. Concrete curbs, slip form machine or rigid form types.
4. Reinforcing steel, anchor bolts, forms and form removal.

1.02 QUALITY ASSURANCE

A. Comply with the following standards:
1. ACI Standards (latest editions) for construction procedures. Including but not limited to:
a. Specifications for Structural Concrete for Buildings (ACI-301).
b. Recommended Practice for Hot Weather Concreting (ACI-305).
c. Recommended Practice for Winter Concreting (ACI-306).
d. Building Code Requirements for Reinforced Concrete (ACI-318-89).
e. Recommended practice for Field Evaluation of Compressive Test Results of Field Concrete (ACI-214).
2. ASTM Standards (latest editions) for material specifications.

B. Testing:
1. Pay costs of independent testing agency approved by Architect/Engineer, tests and necessary re-testing and re-inspection.
2. Perform following tests, by certified concrete field technician.
a. Slump tests: ASTM C 143.
b. Compression tests: ASTM C 31 and C 39.
c. Air entrainment: ASTM C 138 or C 231.
3. Concrete Field Tests:
a. Five (5) 6 inch by 12 inch concrete cylinders shall be molded for each 50 cubic yards or each day's pour if less than 50 yards.
b. Cylinders shall remain undisturbed in a secure location on the site for 24 hours after which they shall be removed to the testing lab by laboratory personnel.
c. Two of the cylinders shall be tested at 7 days and two at 28 days.
d. Failure to the concrete to meet the specification requirements may result in its complete removal and replacement at the Contractor's expense.
e. Cost of re-test, if any, will be at the Contractor's expense.

C. Allowable tolerances:
1. Formed surfaces: Table 4.3.1, ACI 301.
2. Slabs finished level: $\pm$ 1/4" of floor elevation.
3. Class A finishes: True planes $\pm$ 1/8" in ten feet for troweled slabs.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store materials to prevent contamination, deterioration, and weather damage.

B. Deliver ready-mixed concrete to point destination in conformance to ASTM C94.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Cold Weather:
1. Comply with ACI 306 when temperature is 40°F or lower.
2. Maximum concrete temperature 90°F, minimum 50°F per ASTM C94.

B. Hot Weather:
1. Comply with ACI 305.
2. Maximum concrete temperature 90°F.
3. Protect from rapid evaporation by spraying or sheeting.

1.05 SUBMITTALS

A. Reinforcing Steel Shop Drawings:
1. Indicate all reinforcing steel sizes, locations, support locations/details, lengths laps and bend details.
2. Indicate all reinforcing strengths and quantities.

B. Concrete Mix Design:
1. A separate mix design for each class and type of concrete is required.
a. Include literature for admixtures.
b. Include applicable compliance with referenced ASTM number.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement:
1. ASTM C150-71, Type I or II.

B. Air Entraining Cement:
1. ASTM C150, Type IA or IIIA.

C. Aggregates:
1. ASTM C33.
2. Coarse Aggregates:
a. Clean, tough, durable fragments of uncrushed gravel or crushed stone free from dirt or objectionable matter.
b. Size: Maximum 1-1/2" at footings; 1" in slabs.
3. Fine aggregate: Natural sand; clean, sound, hard, durable particles; gradation size No. 1.

D. Water:
1. Clean, free from injurious amounts of oil, acids, alkalies, organic matter or deleterious substances, potable.

E. Admixtures:
1. Air Entraining Agent: Neutralized vinsol resin solution, conforming to ASTM C260.
2. Water Reducing Agent: ASTM C 494, Types as required to provide controlled setting and/or controlled rate of hardening without increase in water/cement ratio or loss in strength.
3. Pozzolan: ASTM C618.
4. Accelerators and retarders: ASTM C 494; permitted only upon approval of Architect/Engineer.

5. Do not use calcium chloride without permission of Architect.

F. Curing Material:
1. Liquid Membrane: ASTM C 309.
2. Acrylic copolymer solution, transparent, quick drying, non-yellowing.
3. Compatible with flooring adhesives.
4. "Kure-N-Seal" by Sonneborn or equivalent.

G. Reinforcement:
1. Bars: ASTM A 615 Grade 60.
2. Welded Wire Fabric: ASTM A 185, 6 x 6 W1.4 x W1.4, or as indicated.
3. Reinforcing fibers will be allowed for use in exterior walks in lieu of welded wire fabric.

H. Expansion Joint filler:
1. Closed cell polyethylene or polyurethane foam.
2. "Sonocrete" by Sonneborn or equivalent.

I. Metal Accessories:
1. Spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing and supporting reinforcing.
2. Minimum 3/4" cover for all metal accessories.

J. Non-Shrink Grout:
1. Pre-mixed, factory packaged, non-staining, non-metallic, non-gassing mortar compound.
2. ASTM C 827, C 191 and C 109.

K. Vertical Joint Sealants:
1. Multi-Component Polyurethane Sealant: Provide manufacturer's standard, non-modified, 2-or-more-part, polyurethane-base, elastomeric sealant; complying with ASTM C920 Type M Class 25, nonsag grade/type.
2. “Sonneborn”, "SONOLASTIC NP II"

L. Horizontal Joint Sealants:
1. Self-leveling grade/type, provide sealant with cured modulus of elasticity at 100% elongation of not more than 150 psi (ASTM D 412 test procedure), and Shore A hardness of not less than 55 (ASTM D 2240). Where nonsag grade/type is required, provide sealant with cured modulus of elasticity at 100% elongation of not more than 75 psi and Shore A hardness of 20 to 30.
2. “Sonneborn”, "SONOLASTIC PAVING JOINT SEALANT"

2.02 MIX DESIGNS

A. Design mix with appropriate adjustments for air content and aggregate proportions.

B. Air Entrainment for concrete exposed to weather: air content controlled between 4 and 6% by volume.

C. Compressive strength at 28 days: 3500 psi.

D. Slump: 3 in. +/- 1 in.

2.03 MIXING

A. Measure and mix materials for ready mixed concrete in conformance with ASTM C94.

B. Take into account free moisture in the aggregate weight.

2.04 FORMWORK

A. Provide formwork to conform to shape, lines and dimensions of members indicated on Drawings.

B. Construct formwork sufficiently tight to prevent leakage.

C. Construct formwork for exposed smooth surfaces of plywood or other similar smooth material.

D. Bevel exposed concrete corners 3/4" unless otherwise indicated on drawings.

E. Form coatings:
1. Non-staining.
2. Apply before reinforcing steel is placed.

F. Tolerances: ACI 347.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure slab subgrade is well drained, of adequate, uniform load bearing nature, and not muddy, soft or frozen.

B. Extend the compacted stone base of the adjacent pavement section beneath the curb and/or gutter for the full width of their construction and profile, whether indicated or not on the Drawings.

C. Dampen subgrade ahead of concreting.

D. Test Below-slab pipes prior to casting concrete.

E. Verify reinforcement and anchors, expansion joint material and embedded items are secured in position.

F. All construction joints shall be keyed vertical bulkheads. No horizontal joints shall be allowed. All reinforcing shall continue through joint.

G. The Architect or his representative shall be given 24 hours notice to inspect placement of reinforcing steel before concrete is placed.

3.02 PLACING

A. Convey concrete from mixer to form as rapidly as practicable, by methods which will prevent segregation or loss of materials.

B. Vertical drops: maximum three feet free fall.

C. Place concrete as nearly as possible to its final position at a rate so it remains plastic and flows readily into position. Proceed with placing as a continuous operation until unit of construction is complete. Use vertical construction joints to avoid horizontal joints between concrete placement.

D. Do not use retempered concrete or concrete partially hardened or contaminated with foreign material.

E. Ensure forms and conveyance equipment is clean and free of ice, water, debris and hardened concrete.

3.03 FINISHING: CONCRETE FINISH SCHEDULE

A. Stoops: Broom finish.

B. Walks: Broom finish. (Hard trowel smooth at expansion and control joints).

C. Steps: Vertical surfaces rubbed; horizontal surfaces broom finish.

D. Retaining Walls: Rubbed.

3.04 CURING

A. Formwork shall remain in place five (5) days before being removed. Remove all formwork in such a manner and at such time as to not damage concrete surfaces and to ensure complete safety to the structure.

B. Slabs and other horizontal surfaces shall be moist cured for seven days or have a curing compound applied immediately following completion of finishing after water sheen has disappeared.

C. Moist curing shall be performed by application of polyethylene sheeting per ASTM C171 or continuous wetting of burlap or other type of absorptive mat.

D. Curing Compounds:
   1. Spray or brush uniformly in a single coat immediately after final finishing operation, at rate recommended by manufacturer.
   2. Do not use material which discolors concrete

E. Meet requirements of hot and cold weather concreting.

3.05 PROTECTION

A. Protect fresh concrete from heavy rains, extreme air temperatures, injurious sun, mechanical injury and other deleterious elements.

B. If scaling occurs from failure to take protective precautions, repair or replace damaged concrete.

3.06 PATCHING

A. Do not patch any surface until examination is made by the Architect and permission is given.

3.07 BUILT-IN WORK

A. Coordinate all openings and chases required in the concrete work and provide all items to be cast into the concrete pour.

3.08 JOINTS

A. Locate and construct all joints as shown on the Drawings, or if not shown, as specified herein, or if not specified, as directed by Architect.

B. Construction Joints.
   1. May be substituted for control or contraction joints in slabs on grade at the indicated locations of such joints or as approved by the Architect.
   2. Provide keyed joints between all cast sections of slabs on grade.

C. Control Joints:

1. Depth: Minimum 1” deep using early entry dry cut saws.
2. Width: Maximum 3/16".
3. 10 feet on center maximum, each way, or as shown on drawings.
4. Walks: as indicated on drawings, or if not indicated, at 4 feet on center or the width of the walk whichever is less.
5. Walls: Size and location as shown on Drawings or 25 feet o.c. each way, whichever is less.
6. Saw cut joints are not acceptable unless authorized in writing by Architect.
7. Wet cut joints within 24 hours of placing.

D. Expansion Joints:
1. Install 1/2" expansion joint filler at concrete pavement joints; hold down below surface or cut the required depth for sealant.

E. Carry reinforcement across joints in slabs except at expansion joints.

SUBMITTAL CHECK LIST

1. Concrete Mix Design.
2. Reinforcement Steel Shop Drawings.

END OF SECTION 32 16 00

SECTION 32 92 00 - LAWNS AND GRASSES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete establishment of lawns.

B. Sod to be provided at areas indicated on the drawings.
If not indicated, sod all banks, swales and other areas were a seeded lawn establishment is impractical.

C. Seed all lawn areas indicated on the drawings. All areas throughout the project that are newly provided or disturbed by any grading activities are to be seeded, whether indicated or not.
See description above for areas to be sodded in lieu of seeding.

D. Seed any areas of construction project limits where disturbed by construction activities, whether indicated or not.

1.02 QUALITY CONTROL

A. Requirements of Regulatory Agencies:
1. Indiana State Seed Law.
2. Indiana Highway Commission Standard Specifications 621.02.

B. Standards:
1. Indiana Association of Nurserymen.
2. American Association of Nursery Horticultural Standards.

C. Source Quality Control:
1. Producer’s tests for purity and germination of seed, dated within nine months of sowing.

1.03 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Deliver seed and fertilizer in supplier’s original unopened package.
2. Deliver sod on pallets.

B. Store seed and fertilizer in cool, dry area protected from exposure to elements, ground moisture or spoilage.

C. Handling:
1. Handle seed and fertilizer materials to prevent contamination or spillage.
2. Protect sod from dehydration, contamination and heating.
3. Keep stored sod moist and shaded or covered with moistened burlap.
4. Do not pile sod over 2 ft. deep.
5. Do not tear, stretch or drop sod.

1.04 SITE CONDITIONS

A. Perform seeding only when preceding related work has been completed.

B. Do not perform seeding after a rain or when wind velocity exceeds 15 mph.

C. Restrict foot and vehicular traffic from lawn areas after planting to end of establishment period.

1.05 SUBMITTALS

A. Product Data:
1. Submit manufacturer's published literature describing products.
2. Submit design mixture of seed and sod.

PART 2 - PRODUCTS

2.01 SEED

A. Percentages by weight, approximate:
1. 80% Fine Blade Fescue (chewings fescue, creeping red fescue and hard fescue).
2. 10% Kentucky Bluegrass.
3. 10% Perennial Rye.

B. Germination:
1. 80% minimum.

2.02 SOD

A. Fine Blade Fescue:
1. Grass composition to match seed mix specified.
2. Fibrous, well and deeply rooted.
3. Grown in general locality of use.
4. Free from all noxious and pernicious weeds.

B. Size:
1. Width: 18" minimum.
2. Length: 36" or as convenient for handling.
3. Thickness: 1" minimum.

C. Grass Height:
1. Uniform thickness with cut height of 3".
2. Soil thickness to be not less than 1" and not more than 1-1/2".

D. Uniformity in color, texture, density and width with even edges.

2.03 SEED-STARTER STRAW MAT / BLANKET

A. Description:
1. Basis of Specification: "Guardian", Seed-Starter Mat.
2. 100% weed-free wheat straw.
3. To keep seed in place, shield seeds from pecking birds and hold moisture for seed germination.
4. To not clump, wash or blow away.
5. Mat/Blanket and all fasteners shall completely biodegrade and disappear once lawn is established, without physical removal.

B. Materials:
1. 3.33 feet wide x 54 feet long roll of seed protection mulch mat/blanket.
2. Biodegradable "BioSTAKEs", 4 inches in length, 36 per roll.

2.04 FERTILIZER

A. Commercial Mixture 8-16-16 or as recommended by State Agricultural Extension Service.

B. Note that this fertilizer mix has a 1-2-2 or low nitrogen N-P-K ratio, which shall be maintained.

2.05 ACCESSORIES

A. Mulch:
1. Straw, weed free, as specified in Indiana Highway Specifications 913.05.
2. Manufactured Products:
a. Conwed Fibers; “Hydro Mulch”.
b. Sylva Corporation, Inc.; “Sylva-Fiber”.

B. Stakes:
1. Softwood, 3/4” x 8”, for sodded slopes as required.

C. Erosion Control Blanket:
1. Basis of Specification:
a. "American Excelsior Company", AEC Premier Straw Double Net.
b. “Forestry Suppliers, Inc.”, Jute Mesh Erosion Control Mat.
2. Acceptable alternate products may be submitted by the Contractor for approval by the Architect.
3. Shall contain agricultural straw fibers, free of weeds, for the purpose of erosion control, revegetation and lawn establishment atop newly seeded areas.
4. Blanket and all fasteners shall completely biodegrade and disappear once lawn is established, without physical removal.
5. May use Seed-Starter Straw Mat / Blanket in lieu of the erosion control blanket.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that preceding work affecting ground surface is completed.

B. Seed:
1. Immediately before seeding is to occur, the entire surface shall be scarified as required and raked until the surface is smooth, friable and a uniformly fine texture.
2. Till soil thoroughly to minimum depth of 4”.
3. Apply fertilizer to soil at rate of 12 pounds per 1,000 square feet immediately prior to seeding.
4. Rake or lightly till fertilizer into soil.

C. Sod:
1. Scarify soil to depth of 2” in compacted area.
2. Apply fertilizer to soil at rate of 12 pounds per 1,000 square feet immediately prior to seeding.
3. Lightly moisten sod immediately prior to laying sod during hot weather.

D. Watering:
1. When topsoil is exceedingly dry, moisten to depth of 4”, 48 to 72 hours prior to start of seeding.
2. Perform watering to prevent run off.

3.02 SEEDING

A. Shall only be done within the seasons as follows, unless allowed by the Architect and Owner:
1. March 1 to May 15.
2. September 1 to October 15.

B. Before the seed is to be sown, all soft spots and inequalities in grade shall be corrected.

C. Prior to seeding, mix commercial fertilizer into the seedbed at a rate of 12 pounds per 1,000 square

feet.

D. Seed shall be spread uniformly over entire area in 2 operations at rate of 5 pounds per 1,000 square feet each, for a total of 10 pounds per 1,000 square feet.

E. Apply second seeding at right angles over the first.

F. Seeding operation may be by mechanical spreader, broadcast method, drill equipment or hydroseed.

G. Lightly cover seed by hand raking lawn areas to depth of 1/4".

H. Smooth and firm all seeded areas with 200 pound roller and water with a fine spray.

I. Install mulch over all seeded areas at a rate of 1,500 pounds per acre and crimp in place for anchorage. It may be applied via hydraulic mulching equipment or may be added to a water slurry in a hydraulic seeder and combined into a single operation. Straw applied at a rate of two bales per 1,000 square feet may serve as an alternative to the aforementioned mechanical mulching process at contractor's option.

J. Contractor shall establish a smooth, uniform turf and surface composed of the specified grasses.

K. Immediately following seeding and mulching, an approved erosion control blanket shall be placed over all areas having a slope of 5:1 or greater. The erosion control blanket shall be staked or stapled into place as per the manufacturer's recommendations. May use Seed-Starter Straw Mat / Blanket in lieu of the erosion control blanket.

3.03 SODDING

A. Shall only be done within the seasons as follows, unless allowed by the Architect and Owner:
   1. March 1 to May 15.
   2. September 1 to October 15.

B. Before the sod is to be laid, all soft spots and inequalities in grade shall be corrected.

C. Prior to sodding, mix commercial fertilizer into the seedbed at a rate of 12 pounds per 1,000 square feet.

D. Lay first row of sod in straight line with long dimension perpendicular to angle of slope.

E. Start sodding at bottom of slopes.

F. Butt rows tightly together so that no voids occur.

G. Stagger end joints.

H. Do not fill joints between pads.

I. Tamp or roll entire sodded area just prior to watering.

J. Provide initial watering of sod as it is being placed.

K. Roll each area immediately after initial watering.

L. Water entire sodded area thoroughly within 4 hours of initial placement.

M. The complete sodded surface shall be true to finished grade, even and firm at all points.

N. Sod on Slopes:
1. Sod on slopes 2:1 or steeper shall be held in place with stakes to secure sod in place along the sloped surface.
2. Stake shall be driven through the sod and into the soil until they are flush with the top of the sod.

3.04 SEED-STARTER STRAW MAT / BLANKET

A. Prepare the area to be protected by raking the soil to a depth of 1 – 2 inches and removing large dirt clods, sticks and other obstructions.

B. Apply seed and fertilizer, as specified for seed, and lightly rake into the soil.

C. Roll out seed-starter mat/blanket over the prepared area making sure to remove any folds or wrinkles in the material. Do not install mat over existing vegetation. If necessary, the mat may be cut to size with sharp scissors or shears.

D. Fasten material to the soil by installing three biodegradable plastic "BioSTAKEs" across the leading edge of the mat, per manufacturer's instructions, by driving them into the ground with a rubber mallet.

E. Continue installation by the mat with "BioSTAKEs" per manufacturer's instructions, being sure to smooth out any wrinkles or folds. If the full roll is not used, secure the terminating end of the mat with three "BioSTAKEs", as done on the leading edge.

F. For large areas requiring more than one mat, seam mats together by overlapping edges 2 – 3 inches and staking per manufacturer's instructions.

G. For very steep slopes and ditches, bury leading edge (edge of mat at top of slope) in a 6 inch by 6 inch trench to prevent runoff water from getting under mat, per manufacturer's instructions.

H. Immediately following installation, gently water entire area, thoroughly wetting both the mat and underlying soil. Keep soil moist for the first 30 to 60 days, or until uniform grass establishment is achieved.

I. Leave mat and biodegradable plastic "BioSTAKEs" in place. They will degrade naturally as grass becomes established and typically can be mowed over within 30 to 45 days.

3.05 LAWN ESTABLISHMENT

A. Provide daily maintenance until lawn is well established.

B. Provide necessary lawn care including fertilizing, weed eradication, watering, mowing, removal of excess clippings and replacement of unsuitable sod.

C. Watering:
1. Keep soil moist during seed germination period.
2. Keep sod moist during first week after planting.
3. Supplement rainfall to produce total of 2 inches per day after germination of seed and after first week for sod.
4. Water planting when soil moisture is below optimum level for best plant growth.

D. Establish period for lawns:

1. Seeded Lawns:
   a. Extend until uniform stand of grass shows over entire area.
2. Sodded Lawns:
   a. Until they have been mowed two times.
   b. Each mowing shall be when height of grass reaches 3" high; cut back to 2-1/2".
   c. Repair erosion damage after second mowing.

3.06 CLEAN-UP

A. Remove trash and excess materials from the project site.

B. Maintain paved areas in clean conditions.

C. Remove barriers and signs from project site at termination of establishment period.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 32 92 00

SECTION 33 11 00 - WATER DISTRIBUTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Rerouting of domestic water system pipe and fittings for new building addition.

B. Provide and install new concrete vault for domestic water and fire protection systems.

C. Rerouting of fire protection water system pipe, valves, and fittings for new building addition.

D. Provide and install new fire hydrant.

E. All costs associated with all permits, connection fees, survey documentation, as-built drawings, third-party tapping contractor if required by utility company, overtime if utility requires service interruption outside regular work hours, and like costs and scope of work.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):
1. ASTM D 1785 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
2. ASTM D 2241 - Specification for Polyvinyl Chloride (PVC) Pressure Rated Pipe (SDR Series).
3. ASTM D 3034 - Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings.
4. ASTM D 3139 - Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

B. American Water Works Association (AWWA):
1. AWWA C 110 - Gray Iron Fittings, 3 inches through 48 inches, for Water and Other Liquids.
2. AWWA C 111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C 151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
4. AWWA C 504 - Rubber Seated Butterfly Valves.
5. AWWA C 509 - Resilient Seated Gate Valves 3 inch through 12 inch NPS, for Water and Sewage Systems.
6. AWWA C 600 - Installation of Ductile-Iron Water Mains and Appurtenances.
7. AWWA C 900 - Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water.

1.03 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 SUBMITTALS

A. Product Data for each type of pipe, pipe fitting, valve and accessory.

PART 2 - PRODUCTS

2.01 PIPE

A. Pipe sizes 2 inches and smaller that are installed below grade and outside building:
1. HDPE pressure rated pipe flexible pipe
2. Meet requirements of AWWA C901 and comply with ASTM D 2239 SIDR 9 (Pressure Rated 200 psi).

B. Pipe sizes 3 inches and larger that are installed below grade and outside building shall comply with one of the following:
   1. Ductile Iron Water Pipe:
      a. In accordance with AWWA C 151.
      b. Fittings shall be mechanical joint or push-on joint complying with AWWA C 110 or AWWA C 111 (Class 50).
   2. Polyvinyl Chloride (PVC) Water Pipe:
      a. Meet requirements of AWWA C900-16 and comply with ASTM D 2241, DR 18 (Pressure Rated 235 psi).
      b. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139, with factory supplied elastomeric gaskets and lubricant.

2.02 GATE VALVES - 2 INCHES AND LARGER

A. Manufacturers: Mueller Resilient Seat Gate Valves.

B. AWWA C509, Iron Body, bronze mounted double disc, parallel seat type, non-rising stem with square nut, single wedge, resilient seat, flanged or mechanical joint ends, control rod, post indicator where noted on drawings, extension box and valve key.

2.03 BALL VALVES - 2 INCHES AND SMALLER

A. Manufacturers: Mueller Oriseal.

B. Brass Body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA compression inlet end, compression outlet with electrical ground connector, with control rod, extension box and valve key.

2.04 BUTTERFLY VALVES - 2 INCHES TO 24 INCHES

A. AWWA C 504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

2.05 CHECK VALVES , POST INDICATOR VALVES, AND BACKFLOW PREVENTORS

A. Specified in Section 21 13 13 – Wet Pipe Fire Suppression Sprinklers.

2.06 HYDRANTS

A. Type as required by utility company, local authority having jurisdiction and as indicated on the drawings. Shall be UL listed and comply with the American Water Works Association specification C 502-85.

B. Hydrant Extensions: In multiples of 6 inches with rod and coupling to increase barrel length.

C. Hose and Stream Connection: Match sized with utility company, two hose nozzles, one pumper nozzle. Provide connection type as required by local Fire Marshall.

D. Valves and Connections: Provide valve opening size as required by local authority and gated connections to the main.

E. Finish: Primer and two coats of enamel finish paint, color of body and tops per local authority.

2.07 ACCESSORIES

A. Provide concrete thrust blocks using concrete to provide sufficient bearing area to transmit unbalanced

thrust from bends, tees, caps, or plugs to undisturbed soil without loading undisturbed soil in excess of 2,500 PSF at 100 psi water main pressure.

B. Tracer Wire:
   1. Basis of Specification: “Performance Wire and Cable, Inc.”, Tracer Wire.
   2. Description:
      a. Solid copper single conductor tracer wire insulated with a low density polyethylene (LDPE).
      b. Designed to carry a radio signal to aid in the location of buried plastic piping.
   3. Size wire as required, 12 AWG conductor minimum.

C. Identification:
   1. Tracer wire to be terminated at the service entry to the building and exposed for access.
      a. Interior to building: terminate for water service entry at main shut off valve and for fire service entry at riser location.
      b. Exterior to building (when interior is not feasible): terminate above ground at point of entry of piping into building.
   2. Tag and label wire at service point termination as follows:
      a. Domestic Water Lines: “DOMESTIC WATER SERVICE”.
      b. Fire Protection Water Lines: “FIRE PROTECTION WATER SERVICE”.

PART 3 - EXECUTION

3.01 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with fine aggregates.

B. Remove large stones or other hard matter which could damage pipe or impede consistent backfilling or compaction.

C. Cut pipe ends square, ream pipe and tube ends and remove burrs.

D. Remove scale and dirt, on inside and outside, before assembly.

E. Prepare pipe for connections to equipment with flanges or unions.

3.02 BEDDING

A. Excavate pipe trench and place bedding material. Provide trench wall shoring as required.

B. Form and place concrete for pipe thrust restraints at any change of pipe direction and at fittings as indicated on Drawings.

C. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, each layer. Place compacted bedding material to elevation of paving subgrade.

3.03 INSTALLATION - PIPE AND FITTINGS

A. Maintain separation of water main from sanitary and storm sewer piping in accordance with state or local codes or requirements of the Health Department.

B. Install pipe and fittings in accordance with AWWA C600.

C. Install pipe to allow for expansion and contraction without stressing pipe or joints or as specified by pipe manufacturer.

D. Install access fittings in accordance with local codes to permit disinfection of water system performed under this Section.

E. Connections with Existing Pipelines: Where connections are made between new work and existing piping, make connection using suitable fittings for conditions encountered. Make each connection with existing pipe at time and under conditions which least interfere with operation of existing pipeline and in compliance with the local utility company.

F. Form and place concrete for thrust blocks or other specified methods of retainage at each change of direction or end of pipe main.

G. Establish elevations of buried piping in accordance with Section 31 00 00 for work in this Section. Provide 36" minimum cover.

H. Backfill trench in accordance with Section 31 00 00.

I. Install trace wire continuous buried 10 inches below finish grade, above pipe line. Trace wire shall be in accordance with local utilities standards.

3.04 INSTALLATION - VALVES AND HYDRANTS

A. Install gate valves as indicated on Drawings and supported on concrete pads with valve stem vertical and plumb. Install valve boxes in a manner that will not transmit loads, stress, or shock to valve body. Center valve box over operating nut of valve vertical and plumb. Securely fit valve box together leaving cover flush with finished surface.

B. Install fire hydrant assemblies as indicated on Drawings in vertical and plum position with stream/pumper nozzle pointed perpendicular to traffic where hydrant is adjacent to a street, roadway or parking lot drive or toward the protected building unless otherwise directed by local authorities. Support hydrant assembly on concrete pad and firmly braced on side opposite inlet pipe against undisturbed soil and concrete blocking. Place minimum of 6 cu. ft. of crushed stone or gravel around hydrant base and barrel after thrust blocking has cured at least 24 hours. Exercise care when backfilling and compacting so proper vertical position will not be altered.

C. Provide a drainage pit 36 inches square by 24 inches deep filled with 2 inch washed gravel. Encase elbow of hydrant in gravel to 6 inches above drain opening. Do not connect drain opening to sewer.

D. Paint hydrants in accordance with local utility company requirements.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect distribution system with chlorine before acceptance for domestic operation. Amount of chlorine shall be such as to provide dosage of not less than 50 parts/million. Thoroughly flush lines before introduction of chlorinating materials and after contact period of not less than 24 hours, system shall be flushed with clean water until residual chlorine content is not greater than 1.0 part/million. Open and close valves in lines being disinfected several times during contact period. After disinfection, take water sample and bacteriological test in accordance with AWWA specifications. Do not place distribution system in service until approval is obtained from applicable governing authorities.

3.06 SERVICE CONNECTIONS

A. Provide water service connection in compliance with utility company requirements including reduced pressure backflow preventer if required and water meter with by-pass valves and sand strainer and as detailed on drawings.

3.07 FIELD QUALITY CONTROL

A. Site Tests:
   1. Compaction:
      a. Perform inspections prior to and immediately after placing bedding.
      b. Perform tests as specified in Section 31 00 00.

   2. Piping: Water distribution system pipe installed below grade and outside building shall be tested in accordance with following procedures:
      a. Perform the testing of pipe materials, joints, and/or other materials incorporated into the construction of water mains and force mains to determine leakage and watertightness. All pressure pipeline shall be tested in accordance with Section 4 of AWWA C600 latest edition. In the event any state or local code requires a more stringent test, the more stringent shall apply.
      b. Pressure Test: After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure at the point of testing and not less than 1.25 times the working pressure at the highest point along the test section.
      c. Leakage Test: The leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water that must be supplied into the newly laid pipeline, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipeline has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time. No pipeline installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\,P}{133200}$$

L = allowable leakage, (gallons per hour)

S = length of pipe tested, (feet)

D = nominal diameter of pipe, (inches)

P = average test pressure during test, (psig)

      d. Visible Leakage: All visible leaks shall be repaired regardless of the amount of leakage.
      e. Acceptance of Installation: If any test of pipe laid in place discloses leakage greater than that specified, the Contractor shall, at his own expense, locate the leak and make repairs as necessary until the leakage is within the specified allowance. Contractor shall supply all water for testing at no additional cost to the Owner.
      f. Provide one copy of results of meter test and hydrostatic pressure test to Architect and utility company upon completion of water distribution backfilling operations.

SUBMITTAL CHECK LIST

1. Product data for pipe, fittings, valves, and accessories.
2. Meter test.
3. Hydrostatic pressure test.

END OF SECTION 33 11 00

SECTION 33 30 00 - SANITARY SEWAGE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision, and services required to complete the following work indicated, noted, detailed on the drawings and specified herein.

1.02 REFERENCES

A. ASTM C76 - Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

B. ASTM D1785 - PVC Plastic Pipe, schedule 40, 80 and 120.

C. ASTM 02665 - PVC Plastic Drain, Waste and Vent Pipe and Fittings.

1.03 SUBMITTALS

A. Submit manufacturer's product literature.
   1. Published product data sheets.
   2. Include date on pipe materials, pipe fittings, valves and accessories.

PART 2 - PRODUCTS

2.01 SANITARY SEWER PIPING

A. PVC Schedule 40 or 80.

B. Fittings: PVC Schedule 40 or 80, designed for solvent welded constructions.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL

A. Refer to Section 31 00 00 for materials and quality control.

B. Bottom of trench shall be shaped to give substantially uniform support to the lower third of all pipe. The full length of each section of pipe shall rest solidly upon pipe bed.

3.02 INSTALLATION

A. Route piping in orderly manner and maintain gradient.

B. Route piping to minimize excavation. Group piping whenever practical.

C. Install piping to allow for expansion and contraction without stressing pipe, joints or connected equipment.

D. Cleanouts shall be at grade and supported by a poured concrete box 24 inch x 24 inch x 12 inch thick.

E. Establish invert elevations, slopes for drainage 1/8 inch per foot.

F. Provide a minimum of 24" of cover.

SUBMITTAL CHECK LIST

1. Product Literature.

END OF SECTION 33 30 00

SECTION 33 40 00 - SITE DRAINAGE

PART 1 - GENERAL

1.01 WORK INCLUDED
- A. Section Includes:
  1. Polyethylene Plastic Piping (HDPE).
  2. PVC Piping.
  3. Drainage Structures, Risers, and Inlets for Plastic Piping.
  4. Grates and Covers for Plastic Piping.
  5. Surface Slot Drains.

1.02 SUBMITTALS
- A. Product Data:
  1. Manufacturer's product data sheets, cutsheets, specifications and materials description.
  2. Manufacturer's installation and maintenance instructions.

1.03 JOB CONDITIONS
- A. Do not discharge water into sanitary sewers.

- B. Do not discharge water containing settleable solids into storm sewers.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
- A. Polyethylene Plastic Piping:
  1. "Advanced Drainage Systems (ADS)"
  2. “Prinsco”.
  3. “Hancor”.
  4. “Vericore Technologies”.
  5. “Haviland Drainage Products”.
  6. “Freedom Plastics, Inc.”.

- B. Grates and Covers:
  1. "Neenah".
  2. "Advanced Drainage Systems (ADS)".
  3. “Prinsco”.
  4. “Freedom Plastics, Inc.”.
  5. “Drainage Solutions, Inc.”

2.02 MATERIAL
- A. Polyethylene Plastic Piping (HDPE):
  1. Provide one of the following approved products:
     a. "ADS" N-12.
     b. “Prinsco” Goldflo and Goldflo WT.
     c. “Haviland” Smooth Flow Pipe.
  2. Heavy duty, HDPE polyethylene plastic, solid.
  3. Dual wall, corrugated exterior with smooth interior wall.
  4. AASHTO rated for typical highway loads.
  5. Soil-tight joints per AASHTO section 26.
  6. Fiittings, couplings, and joints as required.

7. To comply with all requirements of AASHTO M-252 (3”-10”) and AASHTO M-294 (12” and larger). Includes test methods, dimensions, markings, etc.
8. Minimum pipe stiffness to comply with ASTM D-2412.
9. Pipe and fittings shall be made of polyethylene compounds which meet or exceed the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C per ASTM D-1248.
10. Male and female pipe ends which allow the construction of overlapping, gasketed joints, shall be in accordance with ASTM D-3212.
11. Gaskets shall be flexible, elastomeric neoprene to meet or exceed the requirements of ASTM F-477.

B. PVC Piping:
1. Schedule 40 typical at all lawn and landscape areas.
2. Schedule 80 below all drives, roads, alleys, parking areas and like conditions.
3. Schedule 120 at other conditions where indicated on the Drawings.

C. Drainage Structures, Risers, and Inlets for Plastic Piping:
1. Provide one of the following approved products:
   a. "ADS" Nyloplast Drainage Structures.
   b. “Freedom Plastics, Inc.” Inline Drain Basin Bodies.
2. To include PVC surface drainage basin or inline drain structure, per layout, configuration and inverts as required and/or as indicated on the Drawings.
3. Fittings, couplings, and joints as required.
4. Accommodate correct size and type of grate or cover for each intended condition and use.
5. Male and female pipe ends which allow the construction of overlapping, gasketed joints, shall be in accordance with ASTM D-3212.
6. Gaskets shall be flexible, elastomeric neoprene to meet or exceed the requirements of ASTM F-477.

D. Grates and Covers for Plastic Piping:
1. Provide one of the following approved products:
   a. "ADS" Ductile Grates, drop-in type.
   b. "Freedom Plastics, Inc.” Ductile Grates, drop-in type.
   c. "Neenah", Ductile Grates, drop-in type.
2. Light duty (5,000 lbs. rated) in all lawn or landscape areas or concrete walk areas.
3. Heavy duty (H-20, DOT rated) in all paved areas, parking lots, drives or other vehicular access area.
4. Grates designed to accommodate the heavy-duty PVC drainage structure piping.
5. All inlet grates to be slotted type, domed in all lawn or landscape areas, flat in all paved areas.
6. High flow vane type at all curb inlets, 24” x 36”, unless otherwise noted.
7. Install slots and openings in grates perpendicular to flow of traffic.
8. Manhole and cleanout covers to be solid type version of inlet grates, flat and soil tight.
9. All ductile grates to conform to all requirements of ASTM A-536 grade 70-50-05.

E. Surface Slot Drains:
1. Provide one of the following approved products:
   a. "ADS" Duraslot Surface Drains.
2. Heavy duty, HDPE polyethylene plastic, solid.
3. Dual wall, corrugated exterior with smooth interior wall.
4. Aluminum slot rib mounted through top surface of pipe.
5. Slot height to be 6”, rated for H-20 vehicular loading.
6. Grate within slot strip to be 1/2 - #13 galvanized steel, ADA compliant.
7. End of slot strip to be fitted with a grate connector to join grates.
   Grate connector shall be easily removable to allow hose access to flush out pipeline.
8. Provide end cap and grate anchors to close off the upstream end of the piping and drain.
9. AASHTO rated for typical highway loads.

10. Soil-tight joints per AASHTO section 26.
11. Fiittings, couplings, and joints as required.
12. To comply with all requirements of AASHTO M-252 (4”-10”) and AASHTO M-294 (12” and larger). Includes test methods, dimensions, markings, etc.
13. Minimum pipe stiffness to comply with ASTM D-2412.

14. Pipe and fittings shall be made of polyethylene compounds which meet or exceed the requirements of Type III, Category 4 or 5, Grade P33 or P34, Class C per ASTM D-1248.
15. Male and female pipe ends which allow the construction of overlapping, gasketed joints, shall be in accordance with ASTM D-3212.
16. Gaskets shall be flexible, elastomeric neoprene to meet or exceed the requirements of ASTM F-477.

PART 3 - EXECUTION

3.01 STORM PIPING

A. Installation shall be in accordance with manufacturer’s published recommendations, local City or agency requirements and per ASTM Recommended Practice for the applicable piping material.

B. Lay pipe to provide uniform bearing with 1/8" per foot drainage slopes, or as indicated on the Drawings.

C. Provide and install all couplings, fittings and accessories as required for a complete installation.

D. Seal all joints water tight and soil tight.

E. Provide cleanouts and manholes as indicated on the Drawings.

F. Backfill pipe excavation, particularly bedding, with materials and compaction per manufacturer’s specifications for each condition present, to provide a water tight and soil tight system.

G. Installation depth shall provide for a minimum cover of 1’-0” for all pipe 48” in diameter and less, and 2’-0” for pipe over 60” in diameter.

SUBMITTAL CHECKLIST

1. Product Data.

END OF SECTION 33 40 00