PROJECT MANUAL
FOR CONSTRUCTION OF

TOWN OF CLARKSVILLE
FIRE STATION NO. 1 - NEW FACILITY

TOWN OF CLARKSVILLE
REDEVELOPMENT COMMISSION
Clarksville, Indiana

KovertHawkins
architects

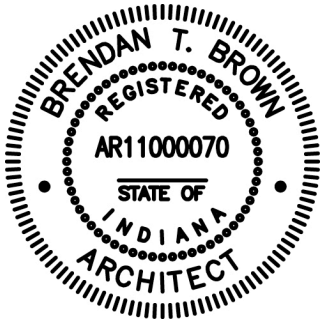
PROJECT MANUAL

FOR CONSTRUCTION OF

TOWN OF CLARKSVILLE
FIRE STATION NO. 1 - NEW FACILITY

TOWN OF CLARKSVILLE
REDEVELOPMENT COMMISSION
Clarksville, Indiana

KOVERT HAWKINS ARCHITECTS, INC.
630 Walnut Street
Jeffersonville, IN 47130
Phone 812.282.9554
812.282.9171
email: brendan.brown@koverthawkins.com
web: www.koverthawkins.com



Brendan T. Brown, AIA
State Registration Number AR11000070

Date: November 28, 2017
File: 201639.01

INDEX TO SPECIFICATIONS

END OF INDEX

SECTION 00100 - NOTICE TO BIDDERS

Notice is hereby given that sealed proposals will be received:

BY: Town of Clarksville
Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

FOR: Fire Station No. 1
New Facility
Clarksville, Indiana

AT: Administration Building
Council Chambers
2000 Broadway
Clarksville, IN 47129

UNTIL: Time of Bid Opening 2:00 PM EST, project local time

DATE: Tuesday, March 6, 2018

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:

Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129
812-288-7155

Kovert Hawkins Architects, Inc.
630 Walnut Street
Jeffersonville, IN 47130
812-282-9554 p

PRE-BID CONFERENCE
DATE: February 20, 2018
TIME: 2:00 PM
LOCATION: Administration Building
Council Chambers
2000 Broadway
Clarksville, IN 47129

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.koverthawkins.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.koverthawkins.com/bid-information for future access.
A list of updated Plan Holders and Addenda will periodically be posted and made available for download.

The Architect retains all copyright to the bid documents, as instruments of their professional service.
Bidders, or any other persons, may not use the PDF files for any other purpose than preparing a bid for this project.

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.

For convenience of the bidders, complete electronic files will also be sent to the following reprographic services. Bidders are responsible for costs of any desired printing of drawings and/or specifications directly from these reprographics services at cost of printing plus any shipping and handling charges.

Don Meredith Company
2434a Crittenden Drive
Louisville, KY 40217
502-636-0155 p
502-634-5771 f

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:
Matt Gullo, RLA, CLARB
Kovert Hawkins Architects, Inc.
matt.gullo@koverthawkins.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.

TOWN OF CLARKSVILLE
REDEVELOPMENT COMMISSION
NOVEMBER 28, 2017

END OF SECTION 00100

AIA® Document A701™ – 1997

Instructions to Bidders

for the following PROJECT:
(Name and location or address)
Town of Clarksville
Fire Station No 1 New Facility
Clarksville, Indiana

THE OWNER:
(Name, legal status and address)
Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

THE ARCHITECT:
(Name, legal status and address)
Kovert Hawkins Architects, Inc.
630 Walnut Street
Jeffersonville, IN 47130

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.

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 other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda issued prior to execution of the Contract.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, or in other Contract Documents are applicable to the Bidding Documents.

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

§ 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 as the base, to which Work may be added or from which Work may be deleted for 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 the amount of 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 The Bidder by making a Bid represents that:

§ 2.1.1 The Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which the Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.

§ 2.1.2 The Bid is made in compliance with the Bidding Documents.

§ 2.1.3 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 personal observations with the requirements of the proposed Contract Documents.

§ 2.1.4 The Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 COPIES

§ 3.1.1 Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement or Invitation to Bid in the number and for the deposit sum, if any, stated therein. The deposit will be refunded to Bidders who submit a bona fide Bid and return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

§ 3.1.2 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the Advertisement or Invitation to Bid, or in supplementary instructions to bidders.

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

§ 3.1.4 The Owner and Architect may make copies of the Bidding Documents available on the above terms for the purpose of obtaining Bids on the Work. No license or grant of use is conferred by issuance of copies of the Bidding Documents.

§ 3.2 INTERPRETATION OR CORRECTION OF BIDDING DOCUMENTS

§ 3.2.1 The Bidder shall carefully study and compare the Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which the Bid is submitted, shall examine the site and local conditions, and shall at once report to the Architect errors, inconsistencies or ambiguities discovered.

§ 3.2.2 Bidders and Sub-bidders requiring clarification or interpretation of the Bidding Documents shall make a written request which shall reach the Architect at least seven days prior to the date for receipt of Bids.

§ 3.2.3 Interpretations, corrections and changes of the Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will 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 No substitution will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. 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.

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

§ 3.3.4 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 all who are known by the issuing office to have received a complete set of Bidding Documents.

§ 3.4.2 Copies of Addenda will be made available for inspection wherever Bidding Documents are on file for that purpose.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Each Bidder shall ascertain prior to submitting a Bid 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 the Bidding Documents.

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

§ 4.1.3 Sums shall be expressed in both words and figures. In case of discrepancy, the amount written in words shall govern.

§ 4.1.4 Interlineations, alterations and erasures 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."

§ 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 make no 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 of the Bidder and the nature of legal form of the Bidder. The Bidder shall provide evidence of legal authority to perform within the jurisdiction of the Work. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further give 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.

§ 4.2 BID SECURITY

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, 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. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 SUBMISSION OF BIDS

§ 4.3.1 All copies of the Bid, the bid security, if any, 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.

§ 4.3.2 Bids shall be deposited at the designated location prior to the time and date for receipt of Bids. Bids received after the time and date for receipt of Bids will be returned unopened.

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

§ 4.3.4 Oral, telephonic, telegraphic, facsimile or other electronically transmitted bids will not be considered.

§ 4.4 MODIFICATION OR WITHDRAWAL OF BID

§ 4.4.1 A Bid may not be modified, withdrawn or canceled by the Bidder during the stipulated time period following the time and date designated for the receipt of Bids, and each Bidder so agrees in submitting a Bid.

§ 4.4.2 Prior to the time and date designated for receipt of Bids, a Bid submitted may be modified or withdrawn by notice to the party receiving Bids at the place designated for receipt of Bids. Such notice shall be in writing over the signature of the Bidder. Written confirmation over the signature of the Bidder shall be received, and date- and time-stamped by the receiving party on or before the date and time set for receipt of Bids. A change shall be so worded as not to reveal the amount of the original Bid.

§ 4.4.3 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids provided that they are then fully in conformance with these Instructions to Bidders.

§ 4.4.4 Bid security, if required, shall be in an amount sufficient for the Bid as resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 OPENING OF BIDS

At the discretion of the Owner, if stipulated in the Advertisement or Invitation to Bid, the properly identified Bids received on time will be publicly opened and will be read aloud. An abstract of the Bids may be made available to Bidders.

§ 5.2 REJECTION OF BIDS

The Owner shall have the right to reject any or all Bids. A Bid not accompanied by a required bid security or by other data required by the Bidding Documents, or a Bid which is in any way incomplete or irregular is subject to rejection.

§ 5.3 ACCEPTANCE OF BID (AWARD)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest qualified Bidder provided the Bid has been submitted in accordance with the requirements of the Bidding Documents and does not exceed the funds available. 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 own best interests.

§ 5.3.2 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 low 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, a properly executed AIA Document A305, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted as a prerequisite to the issuance of Bidding Documents.

§ 6.2 OWNER'S FINANCIAL CAPABILITY

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

§ 6.3 SUBMITTALS

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

- **.1** a designation of the Work to be performed with the Bidder's own forces;
- **.2** names of the manufacturers, products, and the suppliers of principal items or systems of materials and equipment proposed for the Work; 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 in writing 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, (1) withdraw the Bid or (2) submit an acceptable substitute person or entity with an adjustment in the Base Bid or Alternate Bid to cover 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. Bonds may be secured through the Bidder's usual sources.

§ 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 If the Owner requires that bonds be secured from other than the Bidder's usual sources, changes in cost will be adjusted as provided in the Contract Documents.

§ 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 be commenced prior thereto 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. Both bonds shall be written in the amount of the Contract Sum.

§ 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 thereto a certified and current copy of the power of attorney.

ARTICLE 8 FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on AIA Document A101, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment Is a Stipulated Sum.

Additions and Deletions Report for
AIA® Document A701™ – 1997

This Additions and Deletions Report, as defined on page 1 of the associated document, reproduces below all text the author has added to the standard form AIA document in order to complete it, as well as any text the author may have added to or deleted from the original AIA text. Added text is shown underlined. Deleted text is indicated with a horizontal line through the original AIA text.

Note: This Additions and Deletions Report is provided for information purposes only and is not incorporated into or constitute any part of the associated AIA document. This Additions and Deletions Report and its associated document were generated simultaneously by AIA software at 16:30:08 on 12/04/2017.

PAGE 1

Town of Clarksville
Fire Station No 1 New Facility
Clarksville, Indiana

...

Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

...

Kovert Hawkins Architects, Inc.
630 Walnut Street
Jeffersonville, IN 47130

SECTION 00210 - SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

The following supplements modify the Instructions to Bidders, AIA Document A701 - 1997, 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 01630-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 00210

SECTION 00220 – 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00100 - Notice to Bidders
AIA A701 - Instructions to Bidders
Section 00210 - Supplementary Instructions to Bidders
Section 00410 - Bid Security Form
Section 00430 - Subcontractor List
Section 00600 - Contractor's Bond for Construction
Section 00670 - Escrow Agreement
Section 01370 - Schedule of Values
Proposal Form

1.03 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.

1.04 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. **Unit Prices (except where required as part of Proposal Form Part I)**
3. **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 00810-Supplementary General Conditions, Article 13)
7. **Employee Drug and Alcohol Testing**
   (per Section 00810-Supplementary General Conditions, Article 13)
8. **Employment Eligibility Verification**
   (per Section 00810-Supplementary General Conditions, Article 13)

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

END OF SECTION 00220

SECTION 00300 – 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 00301 and Section 00302.
   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 00300

PROPOSAL FORM: PART I
Form 96 (Revised 2013)

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

CONTRACTORS BID FOR: *Fire Station No. 1 – New Facility*
Town of Clarksville
Clarksville, IN 47129

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

Date (Month, Day, Year): _____

Governmental Unit (Owner): *TOWN OF CLARKSVILLE / REDEVELOPMENT COMMISSION*

County: CLARK

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 *TOWN OF CLAKSVILLE / REDEVELOPMENT COMMISSION* (Governmental Unit) in accordance with plans and specifications prepared by Kovert Hawkins Architects, Inc. 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:	*Storage Building*	$ _____
Alternate No. 2:	*Overhead Ceiling Fans*	$ _____
Alternate No. 3:	*Lightning Protection*	$ _____
Alternate No. 4:	East Sidewalk Connection	$ _____

ALLOWANCES

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

Dispatch Alarm System within the **Base Bid** per Section 01210	**$ 45,000**	initials _____
Furniture & Equipment Allowance within the **Base Bid** per Section 01210	**$ 180,000**	initials _____
Utility Pole Relocation within the **Base Bid** per Section 01210	**$ 5,000**	initials _____
Digitally Printed Vinyl Film Allowance within the **Base Bid** per Section 01210	**$ 2,000**	initials _____
Brick Allowance within the **Base Bid** per Section 01210	**$ 800 per 1000**	initials _____
Contingency Allowance within the **Base Bid** per Section 01220	**$ 100,000**	initials _____

COMPLETION OF WORK

Undersigned guarantees, if awarded contract, to complete the 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.

LIST OF PROPOSED UNIT PRICES

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original Contract if accepted by the Governmental Unit. If the bid is to be awarded on a unit basis, the itemization of the units shall be shown on the Proposal Form.

Unit prices shall include the furnishing of all labor, materials, supplies, services, and include all items of cost, overhead and profit for the Contractor and any Subcontractor involved, and shall be used uniformly without modifications, for either additions or deductions for all work performed under the contract.
The Unit Prices as established in accordance with changes in the work, are as follows:

NATURE OF WORK	MEASURE	UNIT OF UNIT PRICE
1. Excavation; soft earth subgrade pockets, including removal from site	Cubic Yard	$ _____
2. Site Fill; crushed stone, hauled, placed, compacted	Cubic Yard	$ _____
3. Engineered Structural Fill; hauled, placed, compacted	Cubic Yard	$ _____

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 00301

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: *TOWN OF CLARKSVILLE / REDEVELOPMENT COMMISSION*

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 00302

SECTION 00305 – 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 beginning construction on site.

B. Tier 1 contractor(s) shall be certified prior to final execution of the Owner/Contractor Agreement.

C. 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 00810, 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 00305

SECTION 00410 - 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 00220 - Contractor's Bid Submittal Checklist for requirements as to time of submission.

END OF SECTION 00410

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)
Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

BOND AMOUNT: $

PROJECT:
(Name, location or address, and Project number, if any)

Town of Clarksville
Fire Station No 1 New Facility

Clarksville, Indiana

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.

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.
/

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 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 00430 - 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 00220 – 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 00430

SECTION 00500 - 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 - 2007, 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 00500

AIA® Document A101™ – 2007

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)

Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

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

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

Town of Clarksville
Fire Station No 1 New Facility

Clarksville, Indiana

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

Kovert Hawkins Architects, Inc.
630 Walnut Street
Jeffersonville, IN 47130
Telephone Number: 812.282.9554
Fax Number: 812.282.9171

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.

AIA Document A201™–2007, 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 the date of this Agreement unless a different date is stated below or provision is made for the date to be fixed in a notice to proceed issued by the Owner.
(Insert the date of commencement if it differs from the date of this Agreement or, if applicable, state that the date will be fixed in a notice to proceed.)

If, prior to the commencement of the Work, the Owner requires time to file mortgages and other security interests, the Owner's time requirement shall be as follows:

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

§ 3.3 The Contractor shall achieve Substantial Completion of the entire Work not later than ( ) days from the date of commencement, or as follows:
(Insert number of calendar days. Alternatively, a calendar date may be used when coordinated with the date of commencement. If appropriate, insert requirements for earlier Substantial Completion of certain portions of the Work.)

Portion of Work	Substantial Completion Date

, subject to adjustments of this Contract Time as provided in the Contract Documents.
(Insert provisions, if any, for liquidated damages relating to failure to achieve Substantial Completion on time or for bonus payments for early completion of the Work.)

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 The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner:
(State the numbers or other identification of accepted alternates. If the bidding or proposal documents permit the Owner to accept other alternates subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

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

Item	Units and Limitations	Price Per Unit ($0.00)

§ 4.4 Allowances included in the Contract Sum, if any:
(Identify allowance and state exclusions, if any, from the allowance price.)

Item	Price

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 certified amount 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 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, unless objected to by the Architect, 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 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

.1 Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of percent (%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 7.3.9 of AIA Document A201™–2007, General Conditions of the Contract for Construction;

.2 Add 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), less retainage of percent (%);

.3 Subtract the aggregate of previous payments made by the Owner; and

.4 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of AIA Document A201–2007.

§ 5.1.7 The progress payment amount determined in accordance with Section 5.1.6 shall be further modified under the following circumstances:

.1 Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work, retainage applicable to such work and unsettled claims; and
(Section 9.8.5 of AIA Document A201–2007 requires release of applicable retainage upon Substantial Completion of Work with consent of surety, if any.)

.2 Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 9.10.3 of AIA Document A201–2007.

§ 5.1.8 Reduction or limitation of retainage, if any, shall be as follows:
(If it is intended, prior to Substantial Completion of the entire Work, to reduce or limit the retainage resulting from the percentages inserted in Sections 5.1.6.1 and 5.1.6.2 above, and this is not explained elsewhere in the Contract Documents, insert here provisions for such reduction or limitation.)

§ 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 Section 12.2.2 of AIA Document A201–2007, 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:

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 INITIAL DECISION MAKER

The Architect will serve as Initial Decision Maker pursuant to Section 15.2 of AIA Document A201–2007, unless the parties appoint below another individual, not a party to this Agreement, to serve as 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 Section 15.3 of AIA Document A201–2007, the method of binding dispute resolution shall be as follows:
(Check the appropriate box. If the Owner and Contractor do not select a method of binding dispute resolution below, 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.)

[ ] Arbitration pursuant to Section 15.4 of AIA Document A201–2007

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

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 A201–2007.

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2007.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 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.)

%

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

Telephone Number: 812.288.7155

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

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

§ 8.6 Other provisions:

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 The Contract Documents, except for Modifications issued after execution of this Agreement, are enumerated in the sections below.

§ 9.1.1 The Agreement is this executed AIA Document A101–2007, Standard Form of Agreement Between Owner and Contractor.

§ 9.1.2 The General Conditions are AIA Document A201–2007, General Conditions of the Contract for Construction.

§ 9.1.3 The Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

§ 9.1.4 The Specifications:
(Either list the Specifications here or refer to an exhibit attached to this Agreement.)

Section	Title	Date	Pages

§ 9.1.5 The Drawings:
(Either list the Drawings here or refer to an exhibit attached to this Agreement.)

Number	Title	Date

§ 9.1.6 The Addenda, if any:

Number	Date	Pages

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

§ 9.1.7 Additional documents, if any, forming part of the Contract Documents:

.1 AIA Document E201™–2007, Digital Data Protocol Exhibit, if completed by the parties, or the following:

.2 Other documents, if any, listed below:

(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201–2007 provides that bidding requirements such as advertisement or invitation to bid, Instructions to Bidders, sample forms and the Contractor's bid are not part of the Contract Documents unless enumerated in this Agreement. They should be listed here only if intended to be part of the Contract Documents.)

ARTICLE 10 INSURANCE AND BONDS

The Contractor shall purchase and maintain insurance and provide bonds as set forth in Article 11 of AIA Document A201–2007.

(State bonding requirements, if any, and limits of liability for insurance required in Article 11 of AIA Document A201–2007.)

Type of insurance or bond	**Limit of liability or bond amount ($0.00)**

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 00600 – 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 00600

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)
Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

Town of Clarksville
Fire Station No 1 New Facility

Clarksville, Indiana

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.

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:)*
	Telephone Number: 812.288.7155

§ 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)
Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

CONSTRUCTION CONTRACT
Date:
Amount: $
Description:
(Name and location)

Town of Clarksville
Fire Station No 1 New Facility

Clarksville, Indiana

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.

BOND
Date:
(Not earlier than Construction Contract Date)

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

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 Payment Bond.)

(FOR INFORMATION ONLY — Name, address and telephone)

AGENT or **BROKER:**

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

Telephone Number: 812.288.7155

§ 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 00670 - 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 00670

SECTION 00700 - 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 - 2007, entitled “General Conditions of the Contract for Construction”.

1. A copy of which is bound herewith.

END OF SECTION 00700

AIA® Document A201™ – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address
Town of Clarksville
Fire Station No 1 New Facility

Clarksville, Indiana

THE OWNER:
(Name, legal status and address)
Town of Clarksville Redevelopment Commission
2000 Broadway
Clarksville, IN 47129

THE ARCHITECT:
(Name, legal status and address)
Kovert Hawkins Architects, Inc.
630 Walnut Street
Jeffersonville, IN 47130

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.

TABLE OF ARTICLES

Init.
/

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 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 and certify termination of the Agreement under Section 14.2.2.

§ 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.

§ 1.2.2 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 will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment 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 this 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 material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them 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 material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect and the Architect's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

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 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or

the portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 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.

§ 2.2.3 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.

§ 2.2.4 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.

§ 2.2.5 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.

§ 2.3 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.

§ 2.4 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 written 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 deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor 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. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

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 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 2.2.3, 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 make 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 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, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and 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 written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required 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 authorized by the Architect in accordance with Sections 3.12.8 or 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

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.

§ 3.6 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 21 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 an equitable adjustment 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 in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed 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 furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply 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 SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be 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, 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 maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be 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 the way by which 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 requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing 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 written 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. 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 cause such services or certifications to be provided by a properly 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, accuracy and completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, 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. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 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, and 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 and patching shall be restored to the condition existing prior to the cutting, fitting and 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 such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's 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 or 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 Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Architect 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 such 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 the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such 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 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.

§ 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.

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

§ 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, except as provided in Section 3.3.1.

§ 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 report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) 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 FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 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 13.5.2 and 13.5.3, whether or not such 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, material and equipment 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, unless otherwise specifically stated by the Architect, 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 authorize 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 duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 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 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 or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply 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 previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, 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, which the Contractor, by these 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 in writing; 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 such 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 Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

§ 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 other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the 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, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor 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 report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report 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, except as to defects not then reasonably discoverable.

§ 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 the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors 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, and the Contractor shall proceed promptly, 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 7.3.7.

§ 7.3.4 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 7.3.5 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.

§ 7.3.6 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.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and 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 7.3.7 shall be limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

.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 related to the Work; and

.5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 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 has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

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, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 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 an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order 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

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.

§ 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's 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. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material 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 material 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, material suppliers, or other persons or entities making a claim by reason of having 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 issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part 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 comprising the Application for Payment, that, to the best of the Architect's knowledge, information and belief, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. 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. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. 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 material 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 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 the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 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 material or equipment suppliers 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 Architect will reflect such payment on the next Certificate 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 material and equipment 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 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, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment 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 and 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, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 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' written 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 shut-down, 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, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall 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 such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment of retainage applying to such 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 as required under Section 11.3.1.5 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 written 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 and, 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 terms and conditions of 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 and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial 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 and (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, 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. If such lien 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 such lien, 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 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 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; or
- **.3** terms of special warranties required by the Contract Documents.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material 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 or the Contractor's Subcontractors or Sub-subcontractors; 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 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 owners and users of adjacent sites and utilities.

§ 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, except damage or loss 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, written notice of such 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

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. 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 report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written 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 such material or substance or who are to perform the task of removal or safe containment of such 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 in the amount of the Contractor's reasonable additional costs of shut-down, 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 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 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 indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance 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 indemnify 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 LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- **.1** Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- **.2** Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- **.3** Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- **.4** Claims for damages insured by usual personal injury liability coverage;
- **.5** Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- **.6** Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- **.7** Claims for bodily injury or property damage arising out of completed operations; and
- **.8** Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction

of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.2 OWNER'S LIABILITY INSURANCE

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or

otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

§ 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 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, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

§ 11.3.7 WAIVERS OF SUBROGATION

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, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, 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 covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance 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 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the

Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

§ 11.4.2 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.

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, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after 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 an 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 written 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 2.4.

§ 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, whether completed or partially completed, of the Owner or separate contractors 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 except that, 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 such 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 such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 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.

§ 13.4.2 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 there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 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 (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 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 13.5.1, 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 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 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.

§ 13.5.4 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.

§ 13.5.5 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.

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

§ 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may 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.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time 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 13.7.

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 or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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 promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, 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' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor 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' written 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 for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;

.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 above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, 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' written 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 as described in 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 written 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 Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

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, 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.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written 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 must 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 CONTINUING CONTRACT PERFORMANCE

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. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

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

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein 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.

§ 15.1.5.2 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.

§ 15.1.6 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 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, 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 arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no 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 such 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 an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, 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 15.1.6 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 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. 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 Either party, at its sole discretion, 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 Either party, at its sole discretion, 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 the Owner and Contractor under this Agreement.

SECTION 00810 - SUPPLEMENTARY GENERAL CONDITIONS

Unless otherwise provided in these Supplemental Conditions, all work shall be governed by the terms of AIA Document A201 - 2007, 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

2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.2 DELETE Subparagraph 2.2.2 in its entirety.

2.2.3 DELETE Subparagraph 2.2.3 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.

2.2.5 Replace Subparagraph 2.2.5 with the following:

The Contractor will be furnished free of charge ten (10) copies of Drawings and Project Manuals. Additional sets will be furnished at the cost of reproduction, postage and handling.

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 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6, 3.5.7, 3.5.8 and 3.5.9.

3.5.2 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.

3.5.3 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.

3.5.4 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.

3.5.5 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.

3.5.6 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 be 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.

3.5.7 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.

3.5.8 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.

3.5.9 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 01210 - Cash Allowances for further provisions on this subject.
Refer to Section 01220 - Contingency Allowance for further provisions on this subject.

3.12 SHOP DRAWINGS, PROJECT DATA AND SAMPLES

Refer to Section 01330 - 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 01732 - Cutting and Patching for further provisions on this subject.

3.15 CLEANING UP

Refer to Section 01740 - Cleaning for further provisions on this subject.

ARTICLE 4 – ARCHITECT AND CONSTRUCTION MANAGER

4.2 ADMINISTRATION OF THE CONTRACT

ADD the following new Subparagraphs 4.2.2.1 and 4.2.2.2:

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 7.3.7.6:

7.3.7.6 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 9.2.2:

9.2.2 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 9.5.4:

9.5.4 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 10.1.1 in its entirety and replace with the following:

10.1.1 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 insure 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 LIABILITY INSURANCE

11.1.2 Add the following limits of liability:

.1 Workmen's Compensation - statutory.
Employer's Liability - $100,000.
.2 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
.3 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
.4 Personal Injury, with employment exclusion deleted:
$1,000,000.
.5 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.
.6 Catastrophic Umbrella Coverage, including products - complete operations:
$2,000,000
.7 Prime Contractors and all subcontractor's insurance shall be primary and non-contributory on all insurance.

Add the following new Subparagraph 11.1.5:

11.1.5 The Contractor shall furnish one copy of Certificate of Insurance, Indiana State Industrial Board Form 18A, 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.

11.3 PROPERTY INSURANCE

11.3.1 Change the last sentence to ADD: "Architects and Engineers of Record after "Subcontractors".

ADD the following new Subparagraph 11.3.7.1:

11.3.7.1 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.

11.3.9 DELETE Subparagraph 11.3.9 in its entirety.

11.3.10 DELETE all words following "insurers" in the first line and put a "." after "insurers".

11.4 PERFORMANCE BOND AND PAYMENT BOND

DELETE the Subparagraph 11.4.1 in its entirety and replace with the following:

11.4.1 The Contractor shall furnish a Performance Bond and Labor and Material Payment Bond meeting all statutory requirements of the State of Indiana and complying with the following requirements:

.1 The form of such bonds shall be acceptable to Owner and in compliance with **Indiana** Statute:

.2 The Bonds shall be executed by a responsible surety licensed in the state in which the Project is located and approved by the Owner and 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.

ADD the following new Subparagraph 11.4.3:

11.4.3 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.

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.

13.5 TESTS AND INSPECTIONS

13.5.7 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.

13.9 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".

13.10 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.

13.11 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.

13.12 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 child care 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

14.4.3 DELETE the words ", and cost incurred by reason of such termination" and REPLACE with "reimbursable costs actually incurred."

DELETE the words "reasonable overhead and profit on" in the second line and REPLACE with "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 00810

SECTION 01110 - 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. Temporary exiting.
   7. Construction scheduling and phasing.

B. Project is being bid with construction work under one General Contract for all trades.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. The Contract Documents apply to the work of this Section.
   Additional requirements necessary to complete the work may be found in other documents.
B. Section 00700 - General Conditions
C. Section 00810 - Supplementary General Conditions
D. Division 1, General Requirements.

1.03 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.

1.04 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.

1.05 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.

1.06 OWNER OCCUPANCY

A. Site will be vacated by Owner prior to Notice-to-Proceed for Contractor's complete use of site during construction.

1.07 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.

1.09 CONSTRUCTION SCHEDULING AND PHASING

A. Owner intends to award the Contract and issue a Notice to Proceed within 60 days after bid opening.
B. Contractor shall mobilize on site and begin work immediately thereafter.
C. **Contractor must achieve Substantial Completion by March 8, 2019 .**
D. **Contractor must achieve Final Completion by April 5, 2019.**

END OF SECTION 01110

SECTION 01130 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. The Contract Documents apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
B. Section 01110 - Summary of Work - Single Contract
B. Section 01120 - Summary of Work - Multiple Contracts
C. Section 01300 - Project Meetings
D. Section 01310 - Project Management and Coordination
E. Section 01320 - Construction Progress Documentation
F. Section 01640 - Owner Furnished Equipment

1.03 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.

1.04 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.

1.05 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 01400-Quality Control for additional requirements.

1.06 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.

1.07 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 01740 - Cleaning for additional requirements.

B. Closeout Procedures:
Refer to Section 01770 - 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 01780 - Closeout Submittals for additional requirements.
3. Refer to Section 01781 - 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 01130

SECTION 01210 - CASH ALLOWANCES

PART 1 – GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
1. Schedule of allowances in Contract Sum for purchase of products, unless installation is also specified.
2. Contractor's costs included in Allowances.
3. Contractor's costs included in Contract Sum.
4. Architect Responsibilities.
5. Contractor's Responsibilities.
6. Correlation with contractor submittals.
7. Adjustment of allowances.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 01110 - Summary of Work - Single Contract
Section 01370 - Schedule of Values
Individual Sections as listed in Schedule Allowances

1.03 SCHEDULE OF ALLOWANCES

A. Furniture & Equipment Allowance:
1. Allow a lump sum fee of **$180,000.00**
2. To be used for purchase, delivery, and installation.
3. Architect will select products, work with vendor, and deliver final invoice to General Contractor.
4. General Contractor will be permitted a 10% total markup above final invoice.
5. To be included in Base Bid of Contract.

B. Dispatch Alarm System Vendor:
1. Allow a lump sum fee of **$45,000.00**
2. To be used for work specified in Section 17725
3. To be included in Base Bid of Contract.

C. Utility Pole Relocation
1. Allow a lump sum fee of **$5,000.00**
2. To be used for relocation of telecommunication pole at the corner of Stansifer Ave. and Sherwood Ave.
3. To be used for utility company to remove pole and relocate at their discretion.
4. To be included in the Base Bid of the Contract.

D. Brick Allowance:
1. Allow a lump sum fee of **$800** per thousand.
2. To be used for purchase and delivery of material to site.
3. Contractor to furnish brick count in thousands required to complete project.
4. To be included in Base Bid of Contract.
5. Refer to Section 04210 - Face Brick Masonry.

E. Digitally Printed Vinyl Film Allowance:
1. Allow and lump sum fee of **$2,000.00**
2. To be used for the production, purchase and installation of digitally printed vinyl film applied to glazing on interior window of Fitness Room.

1.04 CONTRACTOR'S COSTS INCLUDED IN ALLOWANCES

A. Cost of product of Contractor and/or subcontractor, less applicable trade discounts.

B. Delivery to Site.

C. Applicable taxes.

D. Labor for installation, if specified as such.

1.05 CONTRACTOR COSTS INCLUDED IN CONTRACT SUM

A. Product handling at site, including unloading, uncrating, and storage.

B. Protection of products from elements and from damage.

C. Labor for fabrication, installation and finishing, except when installation is specified as part of allowance.

D. Other expenses required to complete installation.

E. Contractor’s overhead and profit.

1.06 ARCHITECT RESPONSIBILITIES

A. Consult with Contractor in consideration of products, suppliers and installers, as applicable.

B. Select products, obtain Owner's written decision and transmit full information to Contractor.
   1. Manufacturer, product, model or catalog number, accessories, attachments, and finishes.
   2. Supplier and installer as applicable.
   3. Cost to contractor, delivered to site and installed as applicable.

1.07 CONTRACTOR RESPONSIBILITIES

A. Assist Architect in determining suppliers and installers, and obtain applicable proposals when requested.

B. Make recommendations for Architect’s consideration.

C. Promptly notify Architect of any reasonable objections against supplier or installer.

D. Upon notification of selection, execute purchase agreement with designated supplier and installer, as applicable, just as with any other subcontractor or supplier on the project.

E. Arrange for processing of shop drawings, product data, and samples.

F. Arrange for delivery. Promptly inspect products upon delivery for completeness, damage, and defects.

G. Install, adjust and finish products.

H. Provide warranties for products and installation.

1.08 CORRELATION WITH CONTRACTOR SUBMITTALS

A. Schedule shop drawings, product data, samples, and delivery dates, in Progress Schedule for products selected under allowances.

1.09 ADJUSTMENT OF ALLOWANCES

A. Contractor shall submit proposal to Architect for any proposed change to allowances.

B. Provide supportive data as required by Architect to substantiate costs of items included in allowances.

C. All proposals shall be authorized by the Architect prior to execution and recorded in Contractor's as-built drawings and Architect's project record documents.

D. Adjustment to Allowances will be made by Change Order.
Any unused amounts to be credited back to the Owner.

END OF SECTION 01210

SECTION 01220 - CONTINGENCY ALLOWANCE

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:

1. Contingency Allowance in Contract Sum.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 01110 - Summary of Work - Single Contract
Section 01120 - Summary of Work - Multiple Contracts
Section 01370 - Schedule of Values

1.03 CONTINGENCY ALLOWANCE

A. Allow a lump sum fee of *$100,000.00.*

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 01220

SECTION 01230 - 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: Storage Building**
   1. Give the amount to be ADDED to the Base Bid for the following:
      a. Construction of entire new storage building.
      b. Associated electric wiring and routing to new storage building.
      c. All concrete walks, concrete stairs to lake, pad at lake.
      d. Any concrete retaining walls needed for concrete stairs to lake and at building.
      e. All demolition as it pertains to tree removal for the new storage building, concrete walks and stairs to lake.
      f. All grading and drainage as it pertains to new storage building, concrete walks, concrete stairs and concrete retaining walls surrounding stairs and walks.
   2. Base Bid to include:
      a. All existing vegetation and earth to remain as existing in the area of the new storage building.
      b. All existing vegetation and earth to remain as existing in the area of the concrete walks, concrete stairs to the lake, and concrete retaining wall at the stairs/storage building.
      c. New segmental retaining wall to end at curbing and not transition into concrete retaining wall.
      d. Concrete curbing to continue straight and not terminate into new storage building.

B. **ALTERNATE NO. 2: Overhead Ceiling Fans**
   1. Give the amount to be ADDED to the Base Bid for the following:
      a. Provide two (2) Airvolution-D 550 (8 Foot Diameter) ceiling fans in Apparatus Bay (Rm 133).
      b. Provide mounting kits, accessories and associated wireing in Bays as indication on Electrical drawings.
   2. Base Bid to include:
      a. No ceiling fans, mounting kits, accessories or associated electrical wiring.

C. **ALTERNATE NO. 3: Lightning Protection**
   1. Give the amount to be ADDED to the Base Bid for the following:
      All work included in specification Section 16620 - Lighting Protection
   2. Base Bid to include: No lightning protection system.

D. **ALTERNATE NO. 4: East Sidewalk Connection**
   1. Give the amount to be ADDED to the Base Bid for the following:
      a. Create new sidewalk/drive path along east side of new fire station and starting at the retaining wall and ending at driveway entrance on neighboring property.
      b. To include all concrete work, grading for sidewalk, materials and labor.
      c. To include six (6) new reserved parking signs for dance studio at parking stalls.
      d. To include new 10’-0” wide fence gate at drive/walk.
      e. To include installation of fourteen (14) new light bollards along walk/drive and all electrical work associated with bollards.
   2. Base Bid to include:
      a. No concrete connection walk/drive at east side of new fire station (and all associated work), area to remain as existing.

END OF SECTION 01230

SECTION 01300 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 01130 - General Construction Requirements
Section 01310 - Project Management and Coordination
Section 01320 - Construction Progress Documentation
Section 01330 - Submittal Procedures
Section 01400 - Quality Control
Section 01770 - Closeout Procedures
Section 01780 - Closeout Submittals
Individuals Specification Sections: Pre-installation conference

1.03 PRE-BID CONFERENCE

A. Architect will administer pre-bid conference to provide further understanding of Scope of Work.
   1. Date: February 20, 2018
   2. Time: 2:00 PM
   3. Location: Administration Building Redevelopment Conference Room 2nd floor, 2000 Broadway, Clarksville, IN 47129

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.

1.04 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.

1.05 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.

1.06 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 01300

SECTION 01310 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00220 - Contractor's Bid Submittal Checklist
Section 01110 - Summary of Work - Single Contract
Section 01120 - Summary of Work - Multiple Contracts
Section 01130 - General Construction Requirements
Section 01300 - Project Meetings.
Section 01320 - Construction Progress Documentation
Section 01330 - Submittal Procedures
Section 01370 - Schedule of Values
Section 01770 - Closeout Procedures
Section 01780 - Closeout Submittals

1.03 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.

1.04 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 00220 – Contractor's Bid Submittal checklist.

C. Submit shop drawings, product data, and other required submittals, in accordance with Section 01330 - 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.

1.05 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 01400 - Quality Control.

1.06 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.

1.07 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 01310

SECTION 01320 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 01300 - Project Meetings.
Section 01330 - Submittal Procedures.
Section 01370 - Schedule of Values.
Section 01770 - Closeout Procedures.
Section 01780 - Closeout Submittals.

1.03 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 01370 - 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.

1.04 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 01780 - Closeout Submittals.

END OF SECTION 01320

SECTION 01330 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 01370 - Schedule of Values
Section 01630 - Product Options and Substitutions
Section 01770 - Closeout Procedures
Section 01780 - Closeout Submittals

1.03 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.

1.04 SUBMITTAL REQUIREMENTS

A. Formats:
   1. Submit all drawings and technical data electronically in PDF format.
      a. Furnish all submittals specified in all sections of the specifications.
      b. Submit each section under a separate transmittal for clarity and ease of review.
      c. Make a complete submittal for each section; do not issue multiple submittals per section.
      d. Compile all sheets, drawings, and product data into a single electronic file for review. Do not submit multiple PDF files per sheet or item.
      e. Identify manufacturer and subcontractor/supplier.
      f. Submit Material and Safety Data Sheets for all products and materials.
      g. Name each PDF file to match specifications title and number, matching that as listed in the project manual.
   2. Submit to Architect via Architect's project management website specific to this project.
   3. 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.

1.05 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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.

1.10 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.

1.11 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.

1.12 RE-SUBMITTALS

A. Make re-submittals under procedures specified for initial submittals; identify changes made since previous submittals.

1.13 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 01330

SECTION 01370 - SCHEDULE OF VALUES

1.01 REQUIREMENTS INCLUDES

A. Section Includes:
   1. General Requirements.
   2. Format and Content.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00220 - Contractor's Bid Submittal Checklist.
Section 01210 - Cash Allowances.
Section 01220 - Contingency Allowance.
Section 01310 - Project Management and Coordination.

1.03 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.

1.04 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 01370

SECTION 01400 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. General Conditions: Inspections and testing required by laws, ordinances, rules, regulations or orders of public authorities
B. Certification of products: Respective Specification sections.
C. Test, adjust and balance of equipment: Respective specification sections.
D. Inspection, Sampling and Testing of Projects: Respective Specifications sections for item required.
E. Division 15.
F. Division 16

1.03 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:	Division 2.
2.	Cast-In-Place Concrete:	Division 3.
3.	Mortar, Grout and CMU Units:	Division 4.
4.	Anchor Bolt Torque:	Division 5.
5.	Structural Steel Connections:	Division 5.
6.	Metal Roof Deck Fastening:	Division 5.
7.	Metal Floor Deck Fastening:	Division 5.
8.	Metal Shingle Roofing:	Division 7.
9.	SBS Modified Bitumen Roofing:	Division 7.
10.	Mechanical testing:	Division 15.
11.	Electrical testing:	Division 16.

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.

1.04 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. GEM Engineering, Inc.
      2219 Plantside Drive; Louisville, KY 40299
      502-493-7100; 502-493-8190 fax
   2. Alt & Witzig Engineering, Inc.
      4105 West 99th Street; Carmel, IN 46032
      317-875-7000; 317-876-3705 fax
   3. Hagerty Engineering, Inc.
      335 Spring Street B; Jeffersonville, IN 47130
      502-553-3211
   4. Asher Engineering, Inc.
      1021 South Floyd Street; Louisville, KY 40203
      502-589-0073; 502-589-0076 fax
   5. Qore, Inc.
      13005 Middletown Industrial Blvd.; Louisville, KY 40223
      502-244-3848; 502-244-3580 fax

1.05 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 two (2) copies 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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.

1.10 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.

1.11 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.

1.12 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.

1.13 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 01320 - Construction Progress Documentation.
   3. Refer to Section 01780 - Closeout Submittals.

END OF SECTION 01400

SECTION 01420 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

The Contract Documents, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other documents.

1.03 SPECIFICATION FORMAT AND CONTENT

A. Specification Format:
   Specifications are organized into Divisions and Sections based on Construction Specifications Institute (CSI) 16-Division format and Master Format numbering system.
   Specific projects may also include an added Division 17-Technology and Communications.

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.

1.04 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.

1.05 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.

1.06 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 01420

SECTION 01510 - 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, fax and internet.
7. Regulatory Agency Requirements.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00700 - General Conditions.
Section 00810 - Supplementary General Conditions.
Section 01110 - Summary of Work - Single Contract.
Section 01120 - Summary of Work - Multiple Contracts.
Section 01130 - General Construction Requirements.

1.03 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, fax, 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, fax 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.

1.04 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, Fax and Internet:
1. Provide, maintain and pay for telephone and fax service to Contractor's field offices throughout construction.
2. Provide, maintain and pay for telephone and fax service to Architect's field offices throughout construction, if separate offices are required for Architect's use.
3. Contractor’s job site superintendent is required to have a cellular/mobile phone at all times during normal working hours.
4. Use of cellular/mobile phones are allowed for temporary phone service, except at field offices.
5. Use of Owner’s lines is prohibited; phone, fax, or internet.
6. 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.

1.05 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 16:
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 15:
   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 15, Mechanical and Division 16, 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 01510

SECTION 01520 - TEMPORARY CONSTRUCTION

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

A. Section Includes:
   1. Temporary Structures:
      a. Contractor's Field Offices.
      b. Architect's Field Office.
      c. Storage Trailers.
      d. Enclosures.
      e. Toilets.
      f. Stairs, Ladders, Ramps, etc.
      g. Temporary Fence.
      h. Project Signage.
      i. Construction Road, Parking Facilities.
   2. Access Roads and Parking Areas.
   3. Installation.
   4. Removal and Cleanup.
   5. Protection.
   6. Temporary Use of Elevator.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00700 - General Conditions.
Section 00810 - Supplementary General Conditions.
Section 01110 - Summary of Work – Single Contract.
Section 01120 - Summary of Work – Multiple Contracts.
Section 01510 - Temporary Utilities.

PART 2 - PRODUCTS

2.01 TEMPORARY STRUCTURES

A. Contractor's Field Offices:
   1. Provided by General Contractor.
   2. Provided by each individual General or Prime Contractor if multiple contracts are applicable.
   3. The Contractor's offices required for general use and project meetings.
   4. Type Option: Portable typical trailer units.
   5. Windows, operable, screened; provide view of construction.
   6. Automatic heating to maintain min 70°F.
   7. Furnish emergency first-aid equipment, ABC fire extinguisher, extra hard hats.
   8. Telephones with loud outside gong on Contractor's line.
   9. Fax line and fax machine.
   10. Furnishings: Provide desk, chairs, adequate drawings reference board, drawing racks, and filing cabinets as needed.
   11. Security: Provide window and door locks so that each office can be made independently secure.
   12. 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 each General or Prime Contractor or subcontractor as required.
   2. Coordinate location with Architect.

3. Remove at project completion and clean up area.

C. Enclosures:
   1. Provided by each individual General or Prime Contractor.
   2. Provide temporary weather-tight enclosures for all exterior openings.
   3. Equip exterior doors with locks and closures.

D. Toilets:
   1. Provided by each individual General or Prime 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 each individual General or Prime 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 each individual General or Prime 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 each individual General or Prime 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.
2. Provide temporary concrete walks and pathways 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.

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.

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 extinguishes 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 01520

SECTION 01610 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00700 - General Conditions.
Section 00810 - Supplementary General Conditions.
Section 01640 - Owner Furnished Equipment.

1.03 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.

1.04 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.

1.05 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 01610

SECTION 01630 - PRODUCT OPTIONS AND SUBSTITUTIONS

PART 1- GENERAL

1.01 REQUIREMENTS INCLUDED

Section Includes:

1. Contractor's options.
2. Requests for substitutions.

1.02 RELATED REQUIREMENTS FOR SUBSITUTIONS SPECIFIED ELSEWHERE

Section 01330- Submittal Procedures.

1.03 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.

1.04 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 01630

SECTION 01732 - 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.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 01110- Summary of Work - Single Contract.
Section 01120- Summary of Work - Multiple Contracts.
Section 01738- Selective Demolition.
Section 01740- Cleaning.

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 01732

SECTION 01740 - 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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Cleaning for Specific Products of Work:
Specification Section for that work, including Divisions 15 and 16.

1.03 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.

1.04 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 01740

SECTION 01770 - 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 01780.
10. Closeout maintenance materials required are specified in Section 01781.

1.02 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00700 - General Conditions.
Section 00810 - Supplementary General Conditions.
Section 00500 - Agreement Form.
Section 01110 - Summary of Work - Single Contract.
Section 01120 - Summary of Work - Multiple Contracts.
Section 01210 - Cash Allowances.
Section 01220 - Contingency Allowance.
Section 01740 - Cleaning.
Section 01780 - Closeout Submittals.

1.03 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.

1.04 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 01780.

1.05 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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 01770

SECTION 01780 - 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 are specified in Section 01781.

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 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

Section 00700 - General Conditions.
Section 00810 - Supplementary General Conditions.
Section 01110 - Summary of Work - Single Contract.
Section 01120 - Summary of Work - Multiple Contracts.
Section 01130 - General Construction Requirements.
Section 01320 - Construction Progress Documentation.
Section 01770 - Closeout Procedures.
Respective Specification Sections.

1.03 OPERATION AND MAINTENANCE MANUALS

A. Submission Requirements:
1. Furnish Owner with all manual information electronically on CD 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 15990 - 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.

1.04 PRODUCT WARRANTIES

A. Submission Requirements:
   1. Furnish Owner with all warranty information electronically on CD 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.

1.05 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 on CD 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 01400 - 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.

2. Preparation of Transparencies:
a. Immediately prior to inspection for Final Acceptance, review completed marked-up record Drawings with Architect. When authorized, prepare a full set of corrected transparencies of Contract Drawings and Shop Drawings.
b. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each Drawing; include printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each Drawing.
c. Refer instances of uncertainty to Architect for resolution.
d. One set of transparencies of original Contract Drawings will be furnished to Contractor by the Owner for use in recording changes and additional information. Other printing as required is Contractor's responsibility.
e. Review of Transparencies:
Before copying and distributing, submit corrected transparencies and original marked-up prints to Architect for review. When acceptable, Architect will initial and date each transparency, indicating acceptance of general scope of changes and additional

information recorded, and of quality of drafting.

f. Transparencies and original marked-up prints will be returned to Contractor for organizing into sets, printing, binding and final submittal.

3. Copies and Distribution:
After completing preparation of transparency Record Drawings, print (three) 3 black-line prints of each Drawing, whether or not changes and additional information were recorded. Organize copies into manageable sets. Bind each set with durable paper cover sheets, with appropriate identification, including titles, dates and other information on cover sheets.
   a. Organize and bind original marked-up set of prints that were maintained during construction in same manner.
   b. Organize record transparencies into sets matching print sets. Place each set in durable tube-type Drawing containers with end caps. Mark end cap of each container with suitable identification.

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.

1.06 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.

1.07 CERTIFICATES OF INSPECTION

A. General.
B. Plumbing.
C. HVAC.

D. Electrical.
E. Fire Sprinkler.
F. Fire Alarm.
G. Elevator.
H. Exhaust Hood.

1.08 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.

1.09 KEYS

A. Submit keys and keying schedule to Owner.

1.10 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.

1.11 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.

1.12 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 the Architect the "Certification of Asbestos and Lead-Based Paint (Existing Building) " for existing buildings or portions of buildings (attached).

D. 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 01780

Certification of Asbestos and Lead-Based Paint
(Existing Building)

To: Kovert Hawkins Architects, Inc.

Subject: Certification for a building built after 1990

Facility name: _____

Facility address: _____

Certification for existing building:
I / We certify under penalty of perjury under the laws of the United States that the following is true and correct. This building was constructed after 1990 and is free of asbestos containing material in excess of 1 percent as defined by applicable US Environmental Protection Agency regulations, and lead-based paint except as specifically listed below. This certification includes all areas of the building(s), including but not limited to; the roof and flooring.

Owner name: _____

Signature: _____

Address: _____

_____

Telephone: _____ Date executed: _____

Materials containing asbestos/lead-based paint	Location/room within facility

The penalty for making a false statement is prescribed by 18 USC 1001.

Certificate of Asbestos and Lead-Based Paint

(New Work)

To: Kovert Hawkins Architects, Inc.

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 01781 - 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. Tile Flooring and Base:
   1. Provide to Owner maintenance stock of at least (6) floor tiles.
   2. Provide to Owner maintenance stock of at least (6) base tiles.

C. Ceramic Tile Flooring and Base (1”x1” or 2”x2”):
   1. Provide to Owner maintenance stock of at least (16) square feet of floor tile.
   2. Provide to Owner maintenance stock of at least (6) linear feet of built-up base tile.

D. Acoustical Ceiling Tile:
   1. Provide to Owner maintenance stock of at least (24) tiles.

E. Rubber Tile Flooring:
   1. Provide to Owner maintenance stock of at least (6) tiles.

F. Vinyl Composition Tile Flooring:
   1. Provide to Owner maintenance stock of at least (10) tiles.

G. Luxury Vinyl Tile Flooring:
   1. Provide to Owner maintenance stock of at least (10) tiles.

H. Rubber Base:
   1. Provide to Owner maintenance stock of at least (20) linear feet.

I. Resilient Athletic Flooring:
   1. Provide to Owner maintenance stock of at least (10) square feet.

J. Resilient Seamless Sheet Flooring:
   1. Provide to Owner maintenance stock of at least (10) square feet.

K. Broadloom Carpeting:
   1. Provide to Owner maintenance stock of at least (50) square feet.

L. Modular Carpet Tiles:
   1. Provide to Owner maintenance stock of at least (6) tiles.

M. Rubber Stair Treads:
   1. Provide to Owner maintenance stock of at least (3) treads.

N. Paint:
   1. Provide to Owner maintenance stock of at least (2) unopened gallon containers.

O. High Performance Coatings:
   1. Provide to Owner maintenance stock of at least two (2) unopened gallon containers.

P. Wall Covering:
   1. Provide to Owner maintenance stock of at least (100) square feet.

Q. Shingles:
   1. Provide to Owner maintenance stock of at least (1) bundle.

R. Auditorium Seating:
   1. Provide to Owner maintenance stock of (2) entire auditorium seating units, all components. Provide with components separated for maintenance replacement; standards, backs, cushions, arms, tablet arms, etc.
   2. Provide to Owner maintenance stock of at least (50) yards of seating fabric. Provide (1) fully upholstered seat cushion for each size of seating provided. Provide (1) fully upholstered seat back for each size of seating provided.
   3. Provide to Owner maintenance stock of at least (10) arm rests of each type provided.

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 01781

SECTION 02010 - 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 (P)
502-589-0076 (F)

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 02010

GEOTECHNICAL ENGINEERING STUDY

PROPOSED CLARKSVILLE FIRE STATION
EAST STANSIFER AVE AT SOUTH SHERWOOD AVE
JEFFERSONVILLE, INDIANA

ASHER PROJECT NO. 17-119

Prepared For:

Matthew D. Gullo, RLA
Kovert Hawkins Architects
630 Walnut Street
Jeffersonville, IN 47130

Prepared By:

Asher Engineering, Inc.
1021 S. Floyd Street
Louisville, Kentucky 40203

November 27, 2017

Asher Engineering, Inc.
Environmental & Engineering Consulting

November 27, 2017

Mr. Matthew D. Gullo, RLA
Kovert Hawkins Architects
630 Walnut Street
Jeffersonville, IN 47130

Re: Geotechnical Engineering Study
Proposed Clarksville Fire Station
E. Stansifer Ave. at S. Sherwood Ave.
Jeffersonville, Indiana

Dear Mr. Gullo,

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 site work; 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 9400375

TABLE OF CONTENTS

1.0 PROJECT INFORMATION

The site is located at the southeast corner of E. Stansifer Ave. and S. Sherwood Ave. (about ¼ mile west of Interstate 65), in Jeffersonville, Indiana. The property is a 1.5 acre rectangular shaped tract and was partially developed with two residential dwellings. The two houses were razed between 2006 and 2007. Evidence of mature trees that have recently been cut down was noted in the southern half of the property. The site is relatively flat with slight changes in elevation at the northern portion and slopes north to south at the southern portion to an existing pond that borders the south property line.

Proposed for construction is a single story L-shaped building with about 10,524 sq. ft. Parking and drive lanes would be provided to the north and south of the building. A paved entrance would be provided off South Sherwood Avenue at the southwest side of the property and a driveway to the proposed building truck bays would be provided off East Stansifer Avenue north of the new building.

2.0 SUBSURFACE EXPLORATION

The subsurface conditions were explored by conducting 10 test borings in the proposed building and pavement areas at the locations shown on the aerial photo in the Appendix. The boring logs (also included in the Appendix) describe the materials encountered.

The test borings revealed about 8 in. of topsoil across the site. The topsoil layer is underlain by about 8 ft. of stiff to very stiff silty clay soil. A 4 to 5 ft. layer of very moist medium stiff clayey silt was encountered below 8 ft. deep with very stiff to hard medium to course sand at about 13 ft. deep. The borings were terminated at 15 ft. No bedrock was encountered in any of the test borings.

3.0 DESIGN RECOMMENDATIONS

The following design recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions. Please notify our office if the project description included herein is incorrect, or if the location of the proposed building is changed. Asher Inc. would then review the new project description to determine if revisions to our recommendations are necessary.

3.1 Site Development

The subsurface conditions are favorable for support of the proposed building on shallow foundations and slab on grade construction. The silty nature of the soils at this site is very sensitive to moisture and vibration from construction traffic. The sitework and performance of the soil subgrade would benefit tremendously if construction was begun in the dry time of the year. The near surface soils were noted to be very moist and somewhat softer than the soils at depth. Some undercutting and stabilization with additional crushed stone may be necessary.

3.2 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 30 in. wide and column footings must be at least 36 in. wide to provide an adequate factor of safety for bearing capacity. All exterior footings and footings in unheated areas must bear at least 30 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).

3.2 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, it is recommended that the slab be supported on a 6-in. layer of KY DGA or IN No. 53 crushed limestone compacted to 100 percent of the standard Proctor.

3.4 Below Grade Walls

Below grade walls should be designed to provide drainage to relieve hydrostatic pressure. A clean, free draining granular fill (KY No. 57 stone) should be used to backfill against below grade walls. The backfill zone should be drained using a perforated pipe at the base of the wall. An Equivalent Hydrostatic Pressure (EHP) of 50 pcf may be used to design below grade walls. A unit weight of 130 pcf should be used for the granular backfill.

3.5 Pavements

The subgrade in any new pavement areas should be proofrolled to identify any soft areas that may require undercutting and stabilization. Assuming proper subgrade preparation and drainage, a California Bearing Ratio (CBR) value of 5 is recommended.

In areas that would be limited to automobiles and light trucks, the following asphalt pavement section is recommended.

Automobile and Light Truck Areas	1.0 in. asphalt concrete surface
	2.0 in. asphalt concrete base
	4.0 in. IN No. 53
	4.0 in. 3-Minus or Surge Stone

Areas that may experience heavier loading conditions should be provided with the following pavement section.

Heavy Truck Areas	1.5 in. asphalt concrete surface
	3.5 in. asphalt concrete base
	4.0 in. IN No. 53
	6.0 in. 3-Minus or Surge Stone

The following rigid pavement section may be used in dock areas.

Rigid Pavement (Concrete)	7.0 in. Concrete
	4.0 in. IN No. 53
	4.0 in. 3-Minus or Surge Stone

All paving material should comply with the current Indiana Department of Highway Specifications. The DGA granular base should be compacted to at least 98 percent of the standard Proctor maximum dry density (ASTM D-698).

4.0 CONSTRUCTION RECOMMENDATIONS

Variations in subsurface conditions must be expected during construction. The geotechnical engineer should be retained to inspect the sitework and correlate the subsurface data with the soil conditions 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 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.

The contractor should exercise discretion when selecting equipment sizes and also control surface water while the subgrade soils are exposed. It may be necessary to undercut and stabilize the proposed pavement areas with crushed stone, or use a geotextile fabric to improve the subgrade, especially if the sitework is done during wet weather conditions.

4.2 Engineered Fill

Engineered fill should be placed on a prepared subgrade that has been evaluated by the geotechnical engineer. Engineered fill should be compacted to at least 98 percent of the standard Proctor maximum dry density (ASTM D-698). 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 foundations shall bear on firm natural or approved engineered fill. The footing excavations should be inspected to confirm suitable bearing. Concrete should be poured the same day the foundation is excavated. Any collection of water shall be promptly evacuated from around poured foundations throughout the construction of the building.

5.0 QUALIFICATIONS

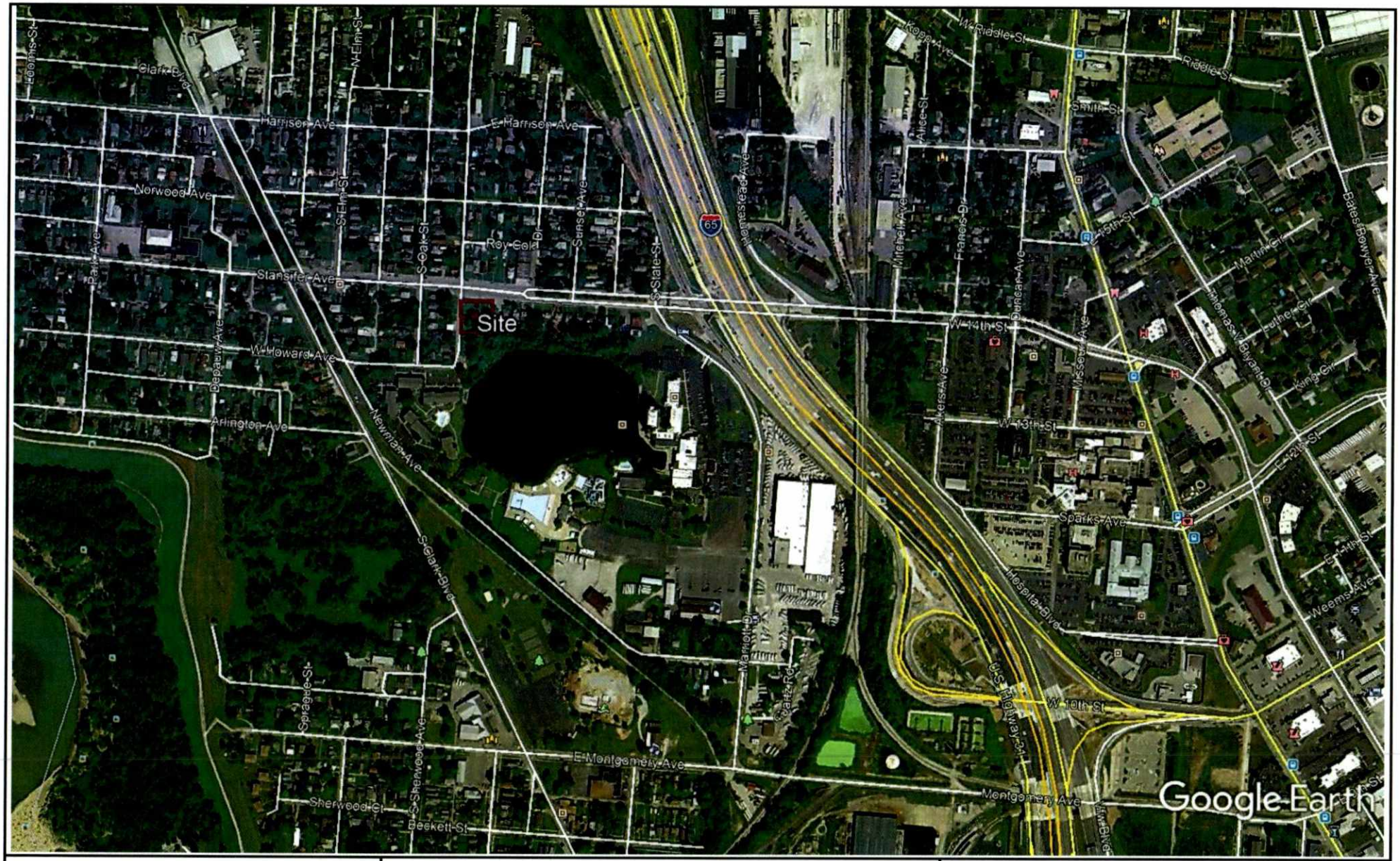
Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either express or implied. Asher, Inc. is not responsible for 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.

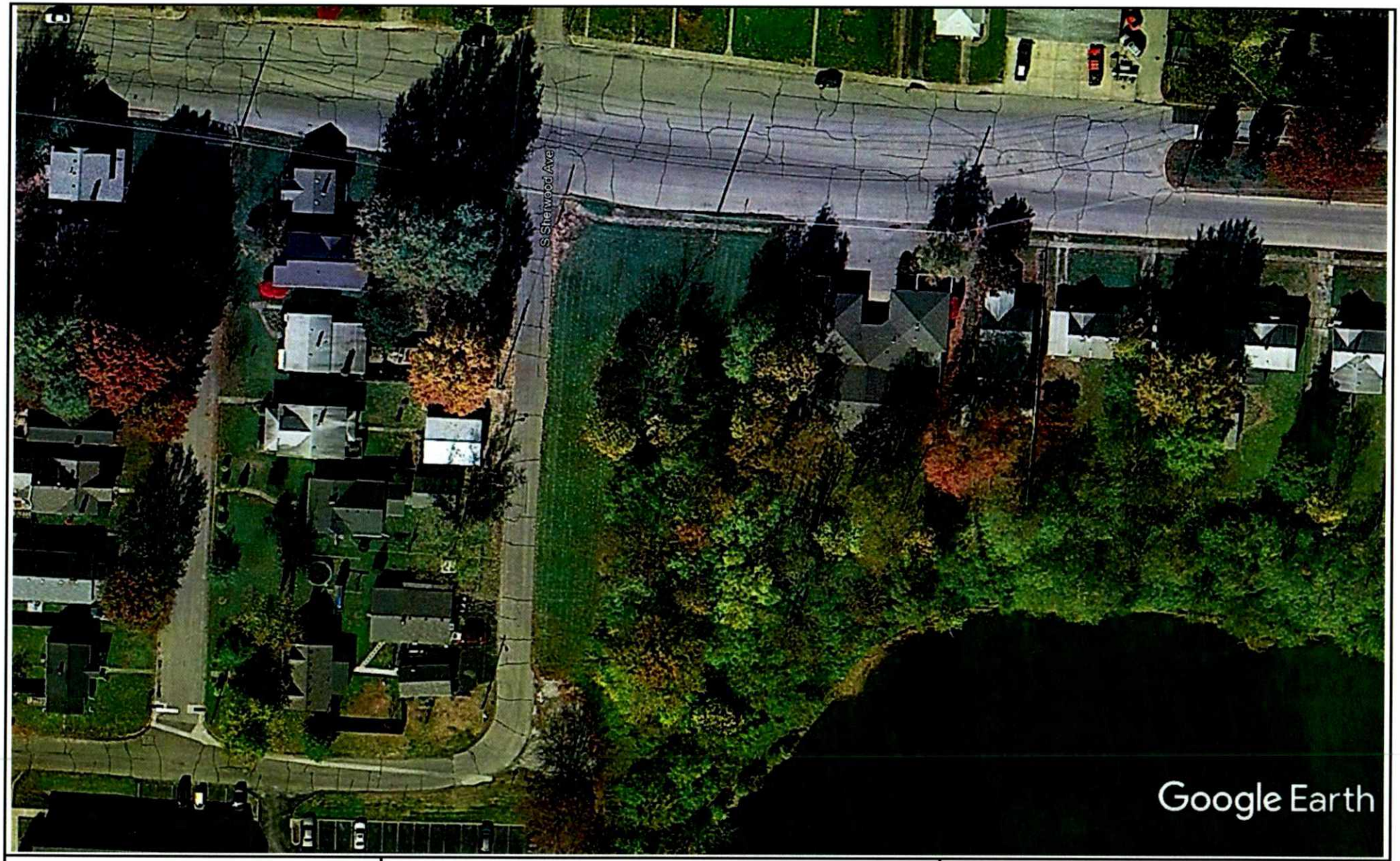
APPENDIX

Site Location
Historical Aerial Photographs
Location of Test Borings
Test Boring Logs



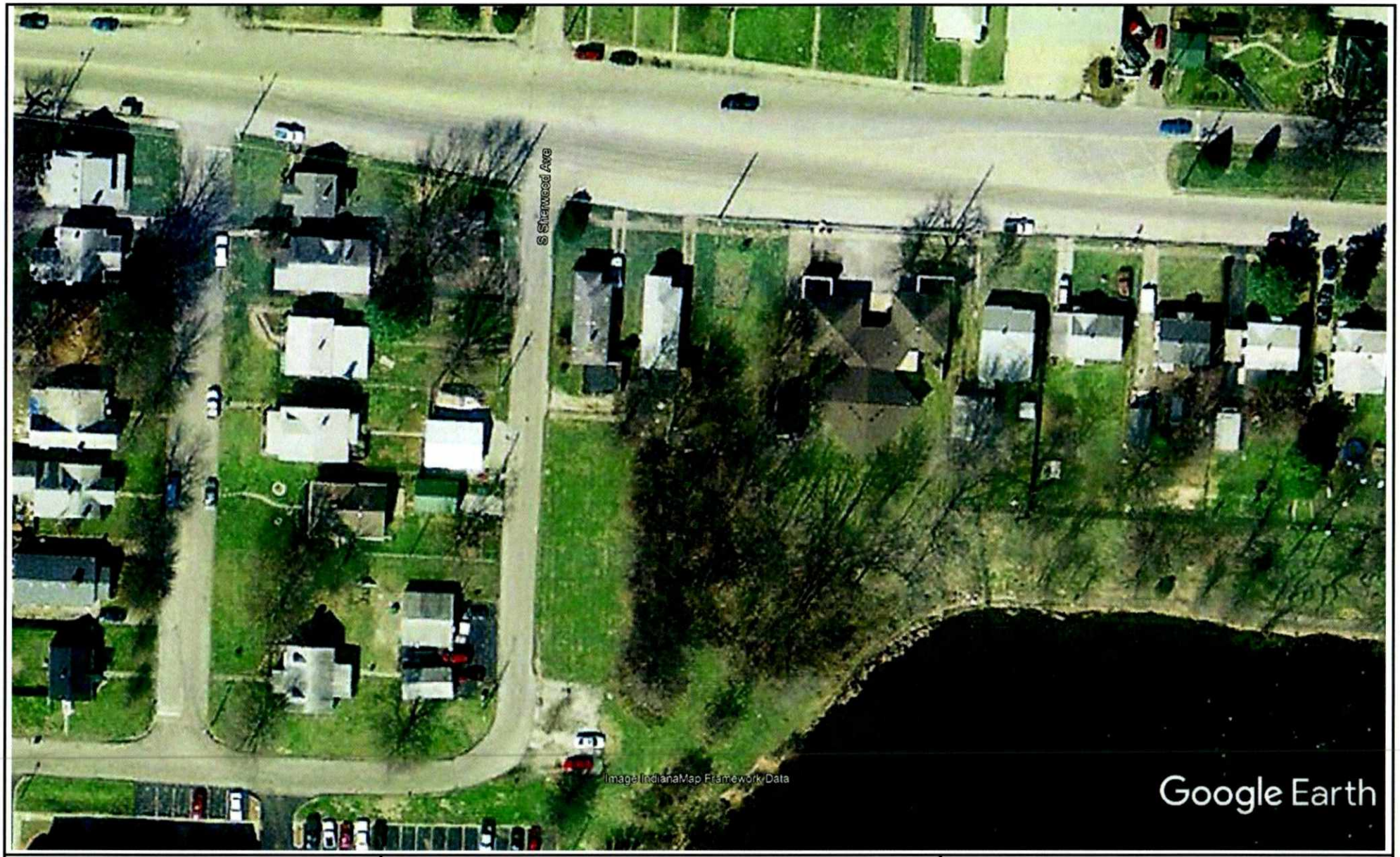
Kovert Hawkins Architects	**Site Location** **Proposed Clarksville Fire Station** **Jeffersonville, Indiana**	**Asher Engineering, Inc.** **Project No.: 17-119** **Photo Date September 2016**

Kovert Hawkins Architects	**Aerial Photo 2016** **Proposed Clarksville Fire Station** **Jeffersonville, Indiana**	**Asher Engineering, Inc.** **Project No.: 17-119** **Photo Date September 2016**



Kovert Hawkins Architects	**Aerial Photo 2013** **Proposed Clarksville Fire Station** **Jeffersonville, Indiana**	**Asher Engineering, Inc.** **Project No.: 17-119** **Photo Date November 2013**

Kovert Hawkins Architects	**Aerial Photo 2010** **Proposed Clarksville Fire Station** **Jeffersonville, Indiana**	**Asher Engineering, Inc.** **Project No.: 17-119** **Photo Date June 2010**



Kovert Hawkins Architects	**Aerial Photo 2005** **Proposed Clarksville Fire Station** **Jeffersonville, Indiana**	**Asher Engineering, Inc.** **Project No.: 17-119** **Photo Date February 2005**

Kovert Hawkins Architects	**Aerial Photo 2001** **Proposed Clarksville Fire Station** **Jeffersonville, Indiana**	**Asher Engineering, Inc.** **Project No.: 17-119** **Photo Date December 2001**

LOCATION of TEST BORINGS

630 Walnut Street
Jeffersonville, IN 47130
812.282.9111 FAX
www.kovert-hawkins.com
KovertHawkins architects

Drawn CP
Checked By MG
Project No. 16.745
Date 11/02/2017

Revisions
1
2
3
4
5
6

Contract No

Clarksville Fire Department
Station No. 1
Stansifer Avenue
Clarksville, IN 47129
Town of Clarksville

New Facility

Sheet
EX 1

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 1

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	1-2-3	5		**SILTY CLAY (CL)** - Reddish brown with some gray; moist; medium stiff; (Possible Fill)
		2	3-3-4	7		**Same** - With less gray soil; stiff; (Natural)
	5	3	3-3-4	7		**SILTY CLAY (CL)** - Reddish brown; very moist; stiff; silty; with rock fragment; low recovery
		4	3-3-3	6		**SILT (ML)** - Brown; wet; medium stiff; trace water at 8' to 9'
	10					
		5	3-3-6	9		**SAND (SP)** - Brown; moist; stiff; fine; dense; with trace clay and gravel
	15					**Terminated at 15 ft.**
	20					
	25					

Notes: 8" of Topsoil.
Trace water between 8' and 9'.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 2

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (Feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	1-1-2	3		**SILTY CLAY (CL)** - Reddish brown with gray; very moist; softer; (Possible Fill)
		2	4-5-6	11		**SILTY CLAY (CL)** - Reddish brown with some gray; moist; stiff
	5	3	2-2-3	5		**SILTY CLAY (CL)** - Reddish brown with trace gray; wet; medium stiff; very silty
		4	3-3-3	6		**SILT (ML)** - Brown; wet; medium stiff; with trace fine sand and trace water at 9' to 10'
	10					**SAND (SP)** - Brown; moist; hard; medium coarse; medium dense; with gravel
		5	10-12-15	27		
	15					**Terminated at 15 ft.**
	20					
	25					

Notes: 8" of Topsoil.
Trace water between 9' and 10'.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 3

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	2-2-3	5		**SILTY CLAY (CL)** - Reddish brown with some gray; very moist; medium stiff
		2	2-2-3	5		**SILTY CLAY (CL)** - Reddish brown with trace gray; very moist; medium stiff
	5	3	2-2-2	4		**SILTY CLAY (CL)** - Reddish brown; very moist to wet; medium stiff; with trace water; low recovery
		4	2-3-3	6		**SILT (ML)** - Brown; wet; medium stiff; with trace water at 8' to 9'
	10					
		5	5-8-17	25		**SAND (SP)** - Brown; moist; very stiff; medium coarse; medium dense; with gravel
	15					**Terminated at 15 ft.**
	20					
	25					

Notes: 8" of Topsoil.
Trace water between 8' and 9'.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 4

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	2-2-5	7		**SILTY CLAY (CL)** - Reddish brown with trace gray; moist; stiff
		2	11-15-12	27		**SILTY CLAY (CL)** - Reddish brown with trace gray; moist to dry; hard
	5	3	10-12-19	31		**Same**
		4	10-10-12	22		**SILTY CLAY (CL)** - Reddish Brown; moist; very stiff; silty with trace of SILT (ML)
	10					**Terminated at 10 ft.**
	15					
	20					
	25					

Notes: 8" of Topsoil.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 5

ELEV.:
Project: Clarksville Fire Station **Project No.:** 17-119
Location: Clarksville, Indiana
Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (Feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	1-1-3	4		**SILTY CLAY (CL)** - Reddish brown with gray; very moist; medium stiff; (Possible Fill)
		2	5-6-9	15		**SILTY CLAY (CL)** - Reddish brown with some gray; moist; very stiff
	5	3	6-8-9	17		**SILTY CLAY (CL)** - Reddish brown with trace gray; dry; very stiff; silty
		4	7-9-10	19		**SILTY CLAY (CL)** - Reddish brown with some brown silt (ML); dry; very stiff
	10					**SAND (SP)** - Brown; moist; very stiff; medium coarse; medium dense; with trace gravel
		5	6-9-11	20		
	15					**Terminated at 15 ft.**
	20					
	25					

Notes: 8" of Topsoil.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 6

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (Feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	2-4-6	10		**SILTY CLAY (CL)** - Reddish brown with gray; moist; stiff
		2	4-12-10	22		**SILTY CLAY (CL)** - Reddish brown with some gray; moist but drier; very stiff; silty
	5	3	8-10-11	21		**SILTY CLAY (CL)** - Reddish brown; dry; very stiff; very silty
		4	5-4-5	9		**SILT (ML)** - Brown; moist; stiff
	10					**SAND (SP)** - Brown; moist; hard; medium coarse; medium dense; with gravel
		5	15-16-19	35		
	15					**Terminated at 15 ft.**
	20					
	25					

Notes: 8" of Topsoil.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 7

ELEV.:
Project: Clarksville Fire Station **Project No.:** 17-119
Location: Clarksville, Indiana
Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (Feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	1-3-4	7		**SILTY CLAY (CL)** - Reddish brown with gray; moist; stiff; with trace of oxidation
		2	8-10-12	22		**SILTY CLAY (CL)** - Reddish brown with trace gray; moist but drier; very stiff; silty
	5	3	8-18-16	34		**SILTY CLAY (CL)** - Reddish brown with trace gray; moist but drier; hard; very silty
		4	8-12-14	26		**SILT (ML)** - Brown with some clay; moist; hard
	10					**SAND (SP)** - Brown; moist; hard; medium coarse; medium dense; with gravel
		5	9-11-13	23		
	15					**Terminated at 15 ft.**
	20					
	25					

Notes: 8" of Topsoil.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 8

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (Feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	1-2-4	6		**SILTY CLAY (CL)** - Reddish brown with gray; moist; medium stiff
		2	6-7-8	15		**SILTY CLAY (CL)** - Reddish brown with some gray; moist; very stiff
	5					**Terminated at 5 ft.**
	10					
	15					
	20					
	25					

Notes: 8" of Topsoil.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 9

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (Feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	1-2-4	6		**SILTY CLAY (CL)** - Reddish brown with trace gray moist; medium stiff; with trace organics
		2	3-4-6	10		**SILTY CLAY (CL)** - Reddish brown; moist; stiff silty
	5					**Terminated at 5 ft.**
	10					
	15					
	20					
	25					

Notes: 8" of Topsoil.

BORING LOG

Asher Engineering
1021 South Floyd St.
Louisville, KY 40203
(502) 589-0073

Boring No.: 10

ELEV.:

Project: Clarksville Fire Station **Project No.:** 17-119

Location: Clarksville, Indiana

Client: Kovert Hawkins Architects **Date:** November 9, 2017

Elev (Feet)	Depth (feet)	Sample Number	SPT Blows / 6"	N	Soil Profile	Description of Material
						Topsoil - 8"
		1	1-3-3	6		**SILTY CLAY (CL)** - Reddish brown with trace gray moist; medium stiff; (Possible Fill)
		2	3-6-7	13		**SILTY CLAY (CL)** - Reddish brown; moist; very stiff; silty
	5					**Terminated at 5 ft.**
	10					
	15					
	20					
	25					

Notes: 8" of Topsoil.

SECTION 02110 - 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.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 02060 - Building Demolition
Section 02200 - Earthwork
Section 02319 - Dewatering

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 02110

SECTION 02200 - 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. Topsoil may remain on site and used for planting beds.

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. Contractor may not fill in the floodplain.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 01400 - Quality Control
Section 02110 - Site Clearing
Division 15 - Plumbing Excavation
Division 16 - Electrical Excavation

1.03 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 1400 - 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.

1.04 SUBMITTALS

A. Written copy of test reports of all tests to the Architect within 48 hours.

1.05 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 02110.
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 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 02200

SECTION 02280 - 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 02280

SECTION 02510 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 02200 - Earthwork.
Section 02720 - Site Drainage.
Section 02750 - Concrete Paving and Curbs.

1.03 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.

1.04 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.

1.05 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.

1.06 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 02510

SECTION 02515 - ASPHALT PAVEMENT REPAIR AND RESURFACING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete the asphalt pavement repair and/or resurfacing 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 Course: 1/4" in 10 ft. maximum.
   2. Surface Course: 1/8" 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. Asphalt pavement Job-Mix formula a minimum of 15 days before asphalt paving is required.

B. Sealcoating Technical Data.

C. Joint and Crack Filler Technical Data.

1.05 SITE CONDITIONS

A. Minimum Ambient Air Temperature (Degrees Fahrenheit).
   1. Base Course: 35°F
   2. Surface Course: 45°F
   3. Prime and Tack Coats - Same as with which work to be included.

B. No prime/tack coats, base or surface courses shall be applied to wet surfaces.

C. Surface course shall NOT be applied before May 1 or after October 15.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:
   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.
   2. Class A, B, C or D.
   3. Meet requirements of IDH Standard Specification, Section 903.02.

D. Fine Aggregate:
1. Sound, angular crushed stone and sharp-edged sand.
2. Meet requirement of IDH Standard Specification; Section 903.01.

E. Primer:
1. Medium Cure Liquid Asphalt or Asphalt Emulsion.
2. Meet requirements of IDH Standard Specification, Section 903.03.

F. Tack:
1. Rapid Cure Liquid Asphalt or Asphalt Emulsion.
2. Meet requirements of IDH Standard Specification, Section 902.04

G. Asphalt Cement:
1. Prepared by the refining of petroleum.
2. Viscosity grade: AC-20
3. Meet requirements of IDH Standard Specification, Section 902.01.

H. Joint and Crack Filler:
1. Flexible elastomeric material with ultra violet inhibitors and asphalt cement.
2. Meet or exceed AASHTO-M173

I. Bituminous Sealer:
1. High solids colloidal dispersion of selected coal tar pitch in water
2. Meet or exceed ASTM D-3320-74T
2. Meet requirements of IDH Standard Specifications.

J. Lane Marking Paint:
1. Factory Mixed, quick drying and non-bleeding alkyd oil based paint.
2. FS TT-P-115, Type III.
3. Color: White, except bus stalls to be yellow.
4. Striping to be ADA blue at handicap spaces.

2.02 TABLE OF COMPOSITION LIMITS

Sieve Size	Metric Size	Percent Passing by Weight	
		Binder	Surface
1 inch	25.0 mm	-	-
3/4 inch	19.0 mm	100	-
1/2 inch	12.5 mm	70 - 92	-
3/8 inch	9.50 mm	50 - 76	100
No. 4	4.75 mm	35 - 40	95 - 100
No. 8	2.36 mm	18 - 45	70 - 90
No. 16	1.18 mm	10 - 36	40 - 68
No. 30	600 μm	6 - 26	20 - 50
No. 50	300 μm	2 - 18	7 - 30
No. 100	150 μm	0 - 11	1 - 20
No. 200	75 μm	0 - 5	0 - 4
Percent of Bitumen		4.3 - 5.4	7.0 - 8.0
Course Aggregate Size (Indiana Highway Standard)		No. 9	-
Fine Aggregate (Indiana Highway Standard)		-	Sand

PART 3 - EXECUTION

3.01 GENERAL

A. All materials shall be spread using approved spreading equipment except when repairing small areas as approved by the architect. Tailgating of aggregates directly onto subgrade 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.

B. 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 PREPARATION

A. All areas of the project to receive pavement repair or resurfacing shall be power broomed and power vacuumed to remove all loose debris, aggregate and trash.

B. Existing deteriorated areas where pavement sections are missing (potholes, etc) or pavement base exhibit signs of becoming unstable shall be identified in the field by the contractor using a paint marking system.

C. Existing pavement cracks over 3/8” wide shall be identified in the field by the contractor using a paint marking system.

D. Contractor and Architect will review all areas after marking to verify all deteriorations have been identified.

3.03 DETERIORATED PAVEMENT REMOVAL

A. Remove deteriorated pavement from the identified areas. Saw cut pavement to provide a clean edge for patching.

B. Removal shall be in a rectangular shape and extend a minimum of 12” beyond all sides of the present deterioration.

C. Existing pavement shall be removed as required to reach a stable base.

D. In areas of base deterioration, complete removal of pavement and granular base is required.

3.04 SUB-BASE STABILIZATION

A. After complete removal of all pavement and base, notify Architect for inspection.

B. Install soil stabilization fabric over entire earth area where pavement and base is removed.

C. Place new stone base materials and compact.

D. If pavement surrounding the removal area is scheduled to receive a new surface course, install binder course of asphalt, minimum 4” thick, up to the same level as existing adjacent pavement.

E. If pavement surrounding the removal area is NOT scheduled to receive a new surface course, install binder course of asphalt, minimum 4” thick, up to a level 1-1/2” below existing adjacent pavement.

3.05 CRACK FILLING

A. All identified cracks over 3/8" wide in areas to receive new pavement surface shall be completely filled.

B. Fill material shall be hot applied between 280-400 degrees F.

C. All filled cracks shall be inspected by Architect prior to installation of asphalt surface course.

3.06 MANHOLE AND CATCH BASINS

A. Manholes:
1. All existing manhole covers shall be raised to be level with new pavement finish.
2. Cut around manhole and remove pavement to allow removal of manhole frame and lid.
3. Install precast concrete rings as necessary to raise elevation of cover.
4. Reinstall cover and frame and fill entire area around frame with concrete up to existing pavement level.

B. Catch Basins:
1. All existing catch basins shall be raised to prevent a severe dip as a result of new pavement overlay.
2. Cut around catch basin a minimum of 24" and remove catch basin grate and frame.
3. Install precast concrete rings as necessary to raise elevation of catch basin frame.
4. Reinstall frame and grate. Fill area around frame with concrete up to 1" below existing asphalt.
5. New asphalt pavement shall slope to catch basin.

3.07 REPAVEMENT EDGES

A. All edges where new pavement surface will not end at a vertical curb, or existing pavement edge shall be blended with the existing pavement surface.

B. Contractor is given the option of using a cut out key-way or milling existing surface edge.

C. Milling:
1. Existing pavement surface where new pavement will abut shall be milled to remove asphalt and provide a smooth transition to the new surface course.
2. Taper the new asphalt to existing while maintaining full design thickness.
3. Seal edge of new surface course to existing using hot applied crack sealer.

D. Key-Way:
1. Saw-cut edges of strip 24" wide the entire length of the abutting edge.
2. Remove asphalt to depth of topping pavement design.
3. Taper the new asphalt to existing while maintaining full design thickness.
4. Seal edge of new surface course to existing using hot applied crack sealer.

E. Joint or edge where new surface meets and existing pavement surface shall be sealed using same hot urethane rubber as for crack filling.

3.08 SPREADING AND ROLLING

A. Base Course, Compacted Stone Aggregates and DGA:
1. Spread and compact in separate lifts, maximum 4" each, see details for depths.
2. Extend lower lift 4" beyond next lift.

B. Binder Course:
1. Spread and roll to minimum finish depths indicate on details.
2. Spread mixture at minimum temperature of 225°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" of true elevation.

D. Primer:
   1. Compacted Aggregate Base Course shall be primed prior to installation of binder course using 0.30 gallons per square yard of cut-back medium cure (MC-70) asphalt or asphalt emulsion (AEP)

E. Tack:
   1. Base course, Binder Course and/or Existing Surface of asphalt shall be tacked prior to installation of subsequent courses using 0.15 gallons per square yard of cut-back rapid cure (RC-70) asphalt or asphalt emulsion (AE-T).

3.09 TRAFFIC-AND LANE MARKINGS

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 product uniform straight edges.
Apply in 2 coats at manufacturer's recommended rates to form 4” minimum width lines.

D. Use pre-cut stencils to paint directional arrows or lettering where noted on the drawings.

SUBMITTAL CHECK LIST

1. Asphalt Paving Mix Formula.
2. Sealcoating Technical Data
3. Joint and Crack Filler Technical Data

END OF SECTION 02515

SECTION 02710 - WATER DISTRIBUTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Domestic water system pipe and fittings.

B. Connection of domestic water system to municipal water system.

C. Fire protection water system pipe, fittings, valves and hydrants.

D. Connection of fire protection water system to municipal water system.

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 RELATED WORK SPECIFIED ELSEWHERE

Section 02200 - Earthwork
Section 02720 - Site Drainage
Section 02730 - Sanitary Sewage

1.03 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.

1.04 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 SUBMITTALS

A. Product Data for each type of pipe, pipe fitting, valve and accessory.

PART 2 - PRODUCTS

2.01 PIPE

A. Pipe sizes less than 3 inches that are installed below grade and outside building:
   1. Polyvinyl Chloride (PVC) Water Pipe.
   2. Conform to ASTM D 2241 with an SDR 21 rating.
   3. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3139 with factory supplied elastomeric gaskets and lubricant.

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 C-900 and comply with ASTM D 2241, rated SDR 21 (Class 150).
      b. Pipe joints shall be integrally molded bell ends in accordance with ASTM D 3034, 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 13900 - Fire Suppression.

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 02200 for work in this Section. Provide 36” minimum cover.

H. Backfill trench in accordance with Section 02200.

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 02200.
   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 02710

SECTION 02720 - SITE DRAINAGE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Section Includes:
1. Perforated Drainage Tile.
2. Polyethylene Plastic Piping (HDPE).
3. PVC Piping.
4. Drainage Structures, Risers, and Inlets for Plastic Piping.
5. Grates and Covers for Plastic Piping.
6. Cast Iron Grates and Covers.
7. Catch Basins
8. Culverts and Headwalls.

B. 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 RELATED WORK SPECIFIED ELSEWHERE

Section 02200 – Earthwork.
Division 15 – Plumbing Systems.

1.03 SUBMITTALS

A. Product Data:
1. Manufacturer's product data sheets, cutsheets, specifications and materials description.
2. Manufacturer's installation and maintenance instructions.

1.04 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. Perforated Drainage Tile:
1. Provide one of the following approved products:
   a. "ADS" Single-Wall Pipe.
   b. “Prinsco” Goldline.
   c. “Haviland” Agricultural Pipe.
2. Heavy duty, HDPE polyethylene plastic, perforated.
3. Single wall, corrugated interior and exterior surfaces.
4. Wrapped with manufacturer’s standard “sock”, heavy-duty polyester synthetic pipe wrap.
5. AASHTO rated for typical highway loads.
6. Soil-tight joints per AASHTO section 26.
7. Fittings, couplings, and joints as required.
8. Slots or circular perforations for water entry, uniformly spaced along the length and circumference of the pipe.
9. Perforations to comply with all requirements of ASTM F-405, ASTM F-667, AASHTO M-252 (3”-10”) and AASHTO M-294 (12” and larger).

B. 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.

C. 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.

D. 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.

E. 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.

F. Cast Iron Grates and Covers:
1. Sizes and configurations as indicated on the Drawings.
2. Heavy duty (H-20, DOT rated) in all areas.
3. All inlet grates to be slotted type, domed in all lawn or landscape areas, flat in all paved areas.
4. Install slots and openings in grates perpendicular to flow of traffic.
5. Manhole and cleanout covers to be solid type version of inlet grates, flat and soil tight.

G. Catch Basins:
1. Precast Concrete, Sitecast Concrete, HDPE Polyethylene, or PVC as indicated on Drawings.
2. Size and configurations as required for each condition.

H. Culverts and Headwalls:
1. Precast Concrete, Sitecast Concrete, HDPE Polyethylene, or PVC as indicated on Drawings.
2. Where not indicated specifically, provide concrete headwall with vertical wall and sides in a U-shaped configuration and a solid bottom face surface connecting these vertical walls for water outlet impact with drain piping outlets integral to the face of the headwall.

PART 3 - EXECUTION

3.01 PERFORATED DRAINAGE TILE

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. Avoid sudden offsets in flow line.

D. Do not lay perimeter drain with bottom of tile below bottom of adjacent footing.

E. Provide and install all couplings, fittings and accessories as required for a complete installation.

F. Backfill pipe with granular drainage fill and per all manufacturer's specifications.

G. Install at line of all perimeter exterior footings, whether indicated on Drawings or not. Coordinate location of final outflow or connection to storm sewer with Architect.

3.02 CULVERTS AND HEADWALLS

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. Pipe length minimum 4 feet beyond edge of drive.

3.03 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 02720

SECTION 02730 - 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.

B. 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 RELATED WORK SPECIFIED ELSEWHERE

Section 02200 - Earthwork
Section 02710 - Water Distribution
Section 02720 - Site Drainage

1.03 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.

1.04 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.

2.02 MANHOLES

A. Precast concrete 48 inch diameter.

B. Provide pipe connections cast into unit.

C. Provide cast iron manhole frame and lid, 24 inch minimum diameter.

D. Manhole steps cast into units.

PART 3 - EXECUTION

3.01 EXCAVATION AND BACKFILL

A. Refer to Section 02200 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.

3.03 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work check tap locations, invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage.

SUBMITTAL CHECK LIST

1. Product Literature.

END OF SECTION 02730

SECTION 02750 - 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 02750

SECTION 02751 – CAST IN PLACE DETECTABLE/TACTILE WARNING SURFACES

PART 1 – GENERAL

1.01 GENERAL DOCUMENTS

A. Drawings and general provisions of Contract, including General and Special Conditions and Division 1 Specifications Section, apply to this Section.

1.02 DESCRIPTION

A. This Section specifies furnishing and installing Detectable/Tactile Warning Surface Tiles in concrete where indicated.

1.03 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's published literature describing products.
   2. Submit manufacturer's installation procedures.

B Shop Drawings:
   1. Showing fabrication details, composite structural system, tile surface profiling.
   2. Plans of tile placement including joints.
   3. Installation materials and procedure.

C. Samples:
   1. Provide color samples. Actual samples may be requested in lieu of color charts.
   2. Color to be selected by Architect from manufacturer's entire selection available.

1.04 QUALITY ASSURANCE

A. Americans with Disabilities Act (ADA): Provide Detectable/Tactile Warning Surface Tiles which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act.

1.05 DELIVERY, STORAGE AND HANDLING

A. Cast In Place Detectable/Tactile Warning Surface Tiles shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation and tile type shall be identified by part number.

1.06 GUARANTEE

A. Cast In Place Detectable/Tactile Warning Surface Tiles shall be guaranteed in writing for a period of five (5) years from date of final completion. The guarantee includes defective work, breakage, deformation, facing and loosening of tiles.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following manufacturers:
   1. Armor-Tile.
   2. Detectable Warning Systems.
   3. U.S.A. Safety Domes.
   4. Vanguard ADA Systems.
   5. ADA Solutions, Inc.
   6. Step Safe.
   7. Advantage Tactile Systems, Inc.
   8. USA Safety Domes.

9. Strong Go Industries.
10. Alert Tile.
11. Armorcast Products Company.
12. Hanover Architectural Products.
13. East Jordan Iron Works.

2.02 WARNING SURFACE SYSTEM

A. Premanufactured units in 24” x 36” or 24” x 48” nominal sizes. Other sizes may be used for irregular shaped conditions.

B. Depth: 1/2” minimum.

C. Water Absorption: Not to exceed 0.05%, ASTM D570.

D. Slip Resistance: Not less than 0.80, ASTM C1028.

E. Color: To be selected by Architect from manufacturer’s entire selection.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Concrete shall be poured and finished to proper level, profile and slope.

B. Install warning surface in wet concrete with anchor lugs per manufacturer instructions.

SUBMITTAL CHECK LIST

1. Product Data.
2. Shop Drawings.
3. Color Samples.

END OF SECTION 02751

SECTION 02835 - SEGMENTED RETAINING WALL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work includes furnishing and installing complete, all segmental retaining walls as shown on the Drawings, to the lines and grades designated and/or as directed by the Architect, including all appurtenant materials required for construction of the retaining wall system.

B. See Drawings for any additional details and requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 02200 - Earthwork.
Section 02720 - Site Drainage.

1.03 QUALITY ASSURANCE

A. Segmental Retaining Wall Units:
   1. ASTM C1372 - Standard Specification for Segmental Retaining Wall Units.
   2. ASTM C 140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units.

B. Geosynthetic Reinforcement:
   1. ASTM D 4595 - Tensile Properties of Geotextiles by the Wide-Width Strip Method.
   2. ASTM D 5262 - Test Method for Evaluating the Unconfined Creep Behavior of Geosynthetics.
   3. GRI:GG1 – Single-Rib Geogrid Tensile Strength.
   4. GRI:GG5 - Geogrid Pullout.

C. Soils:
   1. ASTM D 698 - Moisture Density Relationship for Soils, Standard Method.
   2. ASTM D 422 - Gradation of Soils.
   3. ASTM D 424 - Atterberg Limits of Soil.

D. Drainage Pipe:
   1. ASTM D 3034 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe.
   2. ASTM D 1248 - Specification for Corrugated Plastic Pipe.

E. Engineering Design:
   1. All retaining walls over 48” in effective height shall be designed and certified by a professional engineer, licensed in the State of the project’s location, and acquainted with the system specified.
   2. “NCMA Design Manual for Segmental Retaining Walls,” Second Edition

1.04 SUBMITTALS

A. Manufacturer’s published literature and product data for all materials.

B. Detailed installation drawings; including plans, elevations, details and reinforcement.

C. Unit Sample.

D. Professional Engineer certification (as required).

1.05 DELIVERY, STORAGE AND HANDLING

A. Contractor shall check materials upon delivery to assure that specified type and grade of materials have been received and proper color and texture of units have been provided.

B. Contractor shall prevent excessive mud, wet concrete, epoxies and like materials that may affix themselves from coming in contact with materials.

C. Contractor shall store and handle materials in accordance with manufacturer's recommendations.

D. Contractor shall protect materials from damage.
Damaged materials shall not be incorporated into the retaining wall.

PART 2 - PRODUCTS

2.01 ACCEPTABLE SYSTEMS

A. Provide one of the following acceptable systems:
1. “Versa-Lok Retaining Wall Systems”, Segmental Retaining Wall Units.
2. “Allan Block”, AB Collection.

2.02 SEGMENTAL RETAINING WALL UNITS

A. Machine formed Portland Cement concrete blocks specifically designed for retaining wall applications.

B. Finish:
1. Split face.
2. Textured surface shall extend over all vertical surfaces that will be exposed after completion of wall, including any exposed sides and backs of units.

C. Color:
1. Integral throughout unit.
2. Color as selected by Architect from manufacturer’s entire standard selection.

D. Size:
1. Height of 6 inches.
2. Depth (front face to rear) to height ratio of 2:1, minimum.
3. Units’ molded dimensions shall not differ more than $\pm$ 1/8 inch from that specified, in accordance with ASTM C1372.

E. Weight: 105 PSF wall face area, minimum.

F. Geometry:
1. Faces shall be of straight geometry.
2. Body shall be solid through the full depth of the unit

G. Design:
1. Interlocking design with connection pins.
2. Designed with proper setback to provide 8:1 vertical-to-horizontal batter, (a 7-degree cant from vertical).
3. Capable of being erected with the horizontal gap between adjacent units not exceeding 1/8 inch.
4. Capable of providing overlap of units on each successive course so that walls meeting at corner are interlocked and continuous.
5. Shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the structure. Cracking or excessive chipping are grounds for rejection. Units showing cracks longer than 1/2 inch shall not be used. Units showing chips visible at a distance of 30 feet from the wall shall not be used.

6. Concrete used to manufacture the units shall have a minimum 28 days compressive strength of 3,000 psi and a maximum moisture absorption rate, by weight, of 8% as determined in accordance with ASTM C1372. Compressive strength test specimens shall conform to the saw-cut coupon provisions of ASTM C140.

2.03 CONNECTION PINS

A. Glass-reinforced nylon.

2.04 GEO-SYNTHETIC REINFORCEMENT

A. Geo-grids or Geo-textiles manufactured as soil reinforcement elements.

B. The type, strength and placement location of the reinforcing geosynthetics shall be as determined by the manufacturer's Certifying Engineer, and be shown on the submittals.

2.05 DRAINAGE AGGREGATE

A. Clean angular limestone or washed river gravel.

B. Maximum size, 1".

2.06 DRAINAGE PIPE

A. See Section 02720 - Site Drainage for specifications of piping products.

B. Provide either Perforated Drainage Tile or Polyethylene Plastic Piping (HDPE) as indicated on the Drawings. If not indicated specifically, provide Perforated Drainage Tile at all wall locations for the length of the entire wall and elsewhere that may be indicated.

PART 3 - EXECUTION

3.01 INSPECTION

A. Thoroughly review existing site conditions prior to preparation of wall layout.

3.02 EXCAVATION

A. Excavate to the lines and grades shown on the project grading plans. Take precautions to minimize over-excavation.

B. Verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation. Excavation support, if required, is the responsibility of the Contractor.

3.03 FOUNDATION PREPARATION

A. Foundation soil shall be proof rolled and compacted to 95% standard Proctor density.

B. Leveling pad shall be placed with a minimum thickness of 6 inches. The leveling pad should extend laterally at least 6 inches from the toe and heel of the lower most units.

C. Granular leveling pad material shall be compacted to provide a firm, level bearing surface on which to place the first course of units. Well-graded sand can be used to smooth the top 1/4 to 1/2 inch of the leveling pad.

3.04 UNIT INSTALLATION

A. Unit shall be installed at the proper elevation and orientation.

B. First course of units shall be placed on the leveling pad. The units shall be leveled side-to-side, front-to-rear and with adjacent units, and aligned to ensure intimate contact with the leveling pad.

C. All excess debris shall be cleaned from top of units and the next course of units installed on top of the units below.

D. Connection pins shall be inserted through the pin holes of each upper course unit into receiving slots in lower course units. Pins shall be fully seated in the pin slot below. Units shall be pushed forward to remove any looseness in the unit-to-unit connection.

E. Layout of curves and corners shall be installed in accordance with the wall plan details.

3.05 GEOSYNTHETIC REINFORCEMENT PLACEMENT

A. All geo-synthetic reinforcement shall be installed at the proper elevation and orientation.

3.06 DRAINAGE MATERIALS

A. Drainage aggregate shall be installed to the line, grades and sections shown on the details. Drainage aggregate shall be placed to the minimum thickness shown on the details. Drainage aggregate shall be placed to the minimum thickness shown on the construction plans between and behind units (a minimum of one cubic foot for each exposed square foot of wall face unless otherwise noted on the final wall plans.

B. Drainage collection pipes shall be installed to maintain gravity flow of water outside the reinforced soil zone. The drainage collection pipe shall daylight into a storm sewer or along a slope, at an elevation lower than the lowest point of the pipe within the aggregate drain.

3.07 BACKFILL PLACEMENT

A. The reinforced backfill shall be placed in the maximum compacted lift thickness of 10 inches and shall be compacted to a minimum of 95% of standard Proctor density (ASTM D 698) at a moisture content within 2% of optimum. The backfill shall be placed and spread in such a manner as to eliminate wrinkles or movement of the geo-synthetic reinforcement and the SRW units.

B. Only hand-operated compaction equipment shall be allowed within 3 feet of the back of the wall units.

C. At completion of wall construction, backfill shall be placed level with final top of wall elevation. If final grading, paving, landscaping and/or storm drainage installation adjacent to the wall is not placed immediately after wall completion, temporary grading and drainage shall be provided to ensure water runoff is not directed at the wall nor allowed to collect or pond behind the wall until final construction adjacent to the wall is completed.

SUBMITTAL CHECK LIST

1. Manufacturer Literature.
2. Detailed Installation Drawings.
3. Samples.
4. Professional Engineer Certification.

END OF SECTION 02835

SECTION 02840 – PARKING STOPS

PART 1 – GENERAL

1.01 DESCRIPTION
A. Furnishing and installing prefabricated plastic parking stops where indicated.

1.02 SUBMITTALS
A. Product Data:
1. Submit manufacturer's published literature describing products.
2. Submit manufacturer's installation procedures.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS
A. Belson Outdoors.

B. Checkers Industrial Safety Products.

C. Markstaar.

2.02 PLASTIC PARKING STOPS
A. Premanufactured units: 72" long x 6" wide x 3.25 " high.

B. 100% recycled plastic, solid color.

C. Mounting Hardware:
1. Lagbolt at concrete pavement.
2. Steel spike at asphalt pavement.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Install with anchor system per manufacturer instructions.

SUBMITTAL CHECK LIST
1. Product Data.
2. Shop Drawings.

END OF SECTION 02840

SECTION 02930 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 02110 - Site Clearing.
Section 02200 - Earthwork.
Section 02950 - Trees, Plants and Ground Covers.
Section 02951 - Steel Maintenance Edging
Section 02952 - Aluminum Maintenance Edging
Section 02953 - L-Shaped Aluminum Maintenance Edging

1.03 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.

1.04 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.

1.05 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.

1.06 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 STORMWATER SEED MIX (Cardno Natvie Plant Nursery)

A. Mixture makeup:
   1. Best suited for drainage basins and poor soil/water quality.
   2. At least 10-12 native permanent grasses and sedge species.
   3. Include 12 – 16 native forb species to provide diversity for establishment.

B. Provider (Or Similar):
   1. Cardno Native Plant Nursery; Walkerton, IN
   2. 574-586-2412 phone or nurserysales@cardno.com.

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.

L. Stormwater Seed Mixture, apply per manufacturers recommendations.

3.03 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.

3.04 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.

3.05 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 02930

SECTION 02950 - TREES, PLANTS AND GROUND COVER

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnishing, installing and guaranteeing plantings as scheduled. Furnish labor, materials, equipment, special tools, supervision and services to perform all landscape work indicated, noted and detailed on the drawings and specified herein.

B. Section Includes:
1. Trees and Plants.
2. Wood Mulch.
3. Stone or Rock Mulch.
4. Topsoil.
5. Fertilizer and Herbicide.
6. Accessories.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 01210 - Cash Allowances
Section 02110 - Site Clearing
Section 02200 - Earthwork
Section 02930 - Lawns and Grasses
Section 02951 - Steel Maintenance Edging
Section 02952 - Aluminum Maintenance Edging
Section 02953 - L-Shaped Aluminum Maintenance Edging

1.03 QUALITY ASSURANCE

A. Comply with the following standards:
1. “American Standard for Nursery Stock,” Latest Edition, American Association of Nurserymen.
2. Plant Hardiness Zone Map, Latest Edition, Miscellaneous Publication No. 814 Agricultural Research Service, U.S. Department of Agriculture.
3. Indiana Association of Nurserymen Standards.
4. Indiana State Highway Standard Specifications, Latest Edition.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery:
1. Deliver fertilizer in supplier’s original unopened package.
2. Pack, transport and handle plants with utmost care to protect against injury.
3. Ball and burlap wrap and tie plants, or mud cover bare roots.
4. Maintain plant stock in shade house for week after digging.
5. Label trees and plants to remain legible min. 60 days.
6. Do not prune trees before delivery.

1.05 JOB CONDITIONS

A. Install trees, shrubs and ground cover planting before lawns are installed.

B. Coordinate sequence of work with other trades.

1.06 WARRANTY

A. Guarantee new plant material for one year after all plants are installed.

B. During period of one year, replace dead, dying and unhealthy plants, and those whose appearance has been destroyed due to loss of branches and other damage.

C. Guarantee replacement plants under this guarantee for one year from date of installation.

D. Repair damage to other plants or lawns during plant replacement at no cost to Owner.

E. Guarantee to include plant material, soil preparation, guying and maintenance.

1.07 SUBMITTALS

A. Product Data:
1. Submit manufacturer's published literature describing products.
2. Submit schedule of planting materials or verification of items as scheduled on the Drawings.

PART 2 - PRODUCTS

2.01 PLANTS

A. Planting Schedule:
1. Indicates quantity, size and type of planting.
2. If discrepancies between a listed quantity and plant quantities indicated on the plan, provide quantities as shown on the plan.

B. Quality:
1. True to type, name and variety, well-formed and shaped, with normal, well- developed branches and vigorous root system.
2. Sound, healthy, vigorous, free from defects, disfiguring knots, sun-scald, abrasions, injuries, diseases, insect eggs, borers and all other forms of infections.
3. Nursery grown in accordance with good horticultural practices.
4. Grown under the same climate conditions as the location of this project for at least two (2) years prior to date of planting on this project.
5. Plants which have been held in storage will be rejected if they show signs of growth during storage.
6. Collected plants shall be taken from subgrade favorable to good root development.
7. All collected material shall be clean, sound stock and shall be free from decaying stumps.

C. Measurements:
1. Size and grading conform to American Association of Nurserymen's standards unless otherwise specified.
2. A plant shall be dimensioned as it stands it its natural position.
3. For plants specified by a range of sizes, provide plants not less than the minimum size. Not less than 50% of the plants shall be as large as the average size specified.
4. Large plants which have been cut back to the specified sizes will not be accepted.
5. Take caliper measurements 6" above ground line for trees less that 4" caliper, 12" above ground lines for 4" caliper and larger.
6. Provide plant materials which are matched specimens from a single block source.

2.02 MULCH

A. Natural cypress, shredded, where wood mulch is indicated.

B. Decorative Meramec stone or Decomposed Red Granite Stone, where stone mulch is indicated on Drawings.

C. Hay or straw, weed free, as specified in Indiana Highway Specifications 913.05.

D. Peat Moss:
1. Shredded, loose, free of mineral and waste matter.
2. Minimum organic matter by weight, oven-dry: 85%.

3. Ash content: 10% max.
4. Moisture content: 35% max.

2.03 TOPSOIL

A. Fertile, friable surface soil, free of materials toxic to plant growth.
   1. Classifiable as loam, silt loam, silty clay loam, or clay loam.
   2. PH range of 5.5 - 7.5.
   3. Organic content: 3% min., 20% max. (chromic acid reduction test).
   4. Free of grass, roots, stumps, brush and stone 2” or greater in diameter.

2.04 FERTILIZER AND HERBICIDE

A. Soil fertilizer: Commercial 12-12-12.

B. Granular plant food: Commercial 20-10-5.

C. Planting tablets: Commercial fertilizer plant food tablets, “Agriform”: 20-10-5. 5-25 gram weight.

D. Herbicide: “Ronstar” or equal.

2.05 ACCESSORY MATERIALS

A. Water: Free of oil, acids, alkalis, salts or any substance injurious to plants.

B. Tree Paint: Standard horticultural antiseptic compound.

C. Tree Wrap: Arboricultural wrapping paper, crepe surface, 4” wide, brown color, double layer.

D. Porous Material: Gravel or coarse aggregate #2 ranging from 1 to 3 inches.

E. PVC Pipe: 4” perforated or 4" solid.

F. Miscellaneous Hardware: Eye bolts, cable clamps, turnbuckles, galvanized.

G. Cable: Galvanized steel, 12 gauge.

H. Hose: 2-ply reinforced rubber, ¾” diameter, black or green.

I. Pressure treated timbers and lumber: Osmose or Cuprinol treatment.

J. Antidessicant: “Wilt Pruf”, as manufactured by Nursery Specialty Products, Inc., or equal.

K. Borer Control: Conform to article 611.12 of Highway Specifications.

L. Sand: Medium textured, screened and washed.

PART 3 - EXECUTION

3.01 PREPARATION

A. Pits and trenches with flat, square bottom, a minimum 6” deeper than balls or roots, such that the root crown of plant is flush with finish grade prior to mulching to prevent crown rot.

B. Width: Min. 1 ft. greater that diameter of ball or spread of roots of plants; and 2 ft. greater for trees.

C. Lightly compact the soil well around the rootball of all trees and plants to place them in a straight and true vertical orientation, with the plants self-supporting.

D. If deciduous trees cannot support themselves upright after planting, wrap and guy trees to secure them in position until they achieve the ability to be self-supporting. Protect all trees with tree stakes. Remove all staking within one year of growth.

E. Prepare planting mix in pits under plants and as backfill.

3.02 PLANTING

A. Setting Plants:
1. Locate where indicated on drawing.
2. Set trees plumb and brace in position.
3. Ascertain locations of utility lines, electric cables and conduits, water lines, sprinklers to avoid disturbing subsurface lines and planting.
4. Avoid overhead obstructions to large planting.
5. Remove bindings and wrapping materials from top of balls and around trunks.
6. Do not remove burlap from under balls.

B. Back Filling:
1. Use topsoil mixture containing 25 % peat moss.
2. Fill all voids carefully.
3. Avoid breaking or bruising roots.
4. Tamp backfill firm to prevent settlement.
5. Construct saucer of clay around plants as detailed.
6. Water thoroughly.
7. Add backfill if settling from watering occurs.
8. Apply herbicide to soil surface after backfilling.

C. Pruning:
1. Perform pruning by experienced plantsmen using sharp tools.
2. Prune after planting to remove broken or damaged branches and roots.
3. Improperly pruned plants must be replaced.

D. Mulching:
1. Mulch shrubs to minimum 6” outside drip line of shrubs.
2. Mulch trees and planting beds as shown on drawings.

3.03 PLANTING MAINTENANCE

A. Begin maintenance immediately after planting and continue through one full growing season.

B. Reset plants to upright position to proper grade as necessary.

C. Remove and replace all dead plants.

D. Water, remulch, fertilize, spray, tighten guy wires as required for keeping plants in healthy growing condition.

3.04 CLEAN-UP

A. Remove debris and excess material from site.

B. Clean spills from pavement and finished surfaces.

C. Repair or replace damaged sodded or seeded areas.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 02950

SECTION 02952 - ALUMINUM MAINTENANCE EDGING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services as required for all work related to the Aluminum Maintenance Edging as indicated, noted and detailed on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 02200 - Earthwork
Section 02930 - Lawns and Grasses
Section 02950 - Trees, Plants and Ground Covers

1.03 WARRANTY

A. 15-year limited warranty from manufacturing defects in materials or workmanship.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver in supplier's original unopened package.
   2. Pack, transport and handle plants with utmost care to protect against injury.
   3. Do not bend, twist or break.

1.05 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's published literature describing products.
   2. Submit manufacturer's installation procedures.

PART 2 - PRODUCTS

2.01 MAINTENANCE EDGING

A. Provide one of the following approved manufactured products:
   1. "PermaLoc Corporation", "CleanLine".
      1-800-356-9660

B. Construction:
   1. Constructed for straight-line and gentle curve applications.
   2. Corrugated profile with exposed top edge.
   3. Shall have loops on side of section to receive stakes spaced approximately 2 feet apart along its entire length.

C. Material:
   1. Extruded aluminum, 6063 alloy, T-6 hardness.

D. Size:
   1. 3/16 inch thickness.
   2. 4 inches high.
   3. 8 feet and 16 feet lengths.

E. Connection Method:
   1. Section ends shall splice together with a horizontal 1 inch wide x 4 inches long aluminum sliding connector.

F. Stakes:
   1. Manufactured and supplied by same manufacturer and product set.
   2. 12 inch long standard stake.
   3. Stakes to interlock into preformed section loops.
   4. Provide longer, heavier gage stakes as required to firmly secure into ground as needed for its permanent intended use.

G. Finish:
   1. Mill Finish Natural Aluminum.
   2. All edging, stakes, connectors and accessories to receive the same finish.

PART 3 – EXECUTION

3.01 PREPARATION

A. Ensure that all underground utility lines are located and will not interfere with the proposed edging installation before beginning work.

B. Locate border line of edging with string or other means to assure border straightness and curves as designed.

3.02 INSTALLATION

A. All installation procedures shall be per manufacturer's published Manufactured Guidelines.

B. Set edging into trench with the horizontal base resting on compacted sub-base.

C. Top of edging to be maximum of 1/2 inch above compacted finish grade on turf side.

D. Loops for stakes are to be placed on the turf side.

E. Drive stakes through edging loops until locked in place.

F. Requires minimum of 3 stakes evenly spaced for each 8 feet section and 8 stakes evenly spaced for each 16 feet section.

G. At square corners, notch cut the base only and form a continuous corner from a single piece. Do not abut two separate pieces at a corner.

H. At a curved radius, either at corners or at angled runs, cut edging partially up through its height from bottom and turn back to desired angle to form rounded exposed radius.

3.03 BACKFILLING

A. Backfill both sides of edging.

B. Confirm and adjust if necessary that sections are securely held together.

C. Compact backfill material along edging to provide top of edging at desired height above finish grade of turf.

3.04 CLEAN-UP

A. Remove debris and excess material from site.

B. Clean scraps and shavings from site.

C. Repair or replace damaged sodded or seeded areas.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 02952

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section includes furnishing all labor, tools, materials, equipment and services necessary to properly place and complete all cast-in-place concrete work, both plain and reinforced, including reinforcing steel, forms and other necessary items indicated and/or specified herein and removal of forms.

1.02 RELATED DOCUMENTS

A. The General Provisions of the contract, including General Conditions, Supplemental Conditions and Special Conditions apply to work specified herein.

B. Upon award of contract, the contractor will be furnished a form (See Exhibit "A") similar to that shown at the end of this Section for submittal to the Architect as a part of the mix design submittal.

C. Materials shall comply with requirements of designated specifications of American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania.

D. Construction procedures shall comply with recommendations set forth in designated standards of American Concrete Institute, P.O. Box 19150, Redford Station, Detroit, Michigan, 48129.

E. Current edition of referenced Specifications and Standards shall prevail.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

A. All materials shall be manufactured in the United States of America. Material certificates signed by supplier and contractor certifying that each material item complies with, or exceeds, the specified requirements shall be furnished by the material manufacturer through the general contractor.

B. Portland Cement, Type 1, meeting requirements of A.S.T.M. C150. One brand of cement shall be used throughout the work.

C. Aggregates ..... A.S.T.M. C33.

D. Local aggregates of proven durability may be used when acceptable to the Architect.

E. Coarse aggregate for regular weight concrete may be dredged Ohio River gravel or crushed stone.

F. Water, clean, fresh & potable.

2.02 ADMIXTURES

A. Air-entraining ..... A.S.T.M. C260

B. Chemical (Type subject to approval) ..... A.S.T.M. C494

C. Fly ash shall conform with ASTM C618, Class F or C. Fly ash content shall not exceed 20% by weight of the total cementitious content of the mix.

D. Prohibited Admixtures: Calcium chloride, thiocyanates or admixtures containing more than

0.05% chloride ions are not permitted.

E. Certification: Written conformance to the above-mentioned requirements and the chloride ion content of the admixture will be required from the admixture manufacturer prior to mix design review by the Engineer.

2.03 METAL REINFORCEMENT

A. Deformations ..... A.S.T.M. A305

B. Stirrups and column ties ..... A.S.T.M. A615 Grade 60

C. All other reinforcement ..... A.S.T.M. A615 Grade 60 w/supplementary requirements (S1)

D. Welded Wire Fabric ..... A.S.T.M. A185

E. Metal accessories including spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing and supporting all reinforcement in place shall be provided. Ties shall be of such type as to leave no metal closer than 3/4" from the concrete surface.

2.04 JOINT FILLER

A. Premoulded joint filler strips shall be resilient, compressible, re-expanding, non-extruding, of the thickness indicated.

2.05 FORM OIL

A. Form oil shall be an approved commercial formulation of proven performance that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment and curing of concrete surfaces.

2.06 CURING COMPOUND

A. Curing compound shall be acrylic base type conforming to AASHTO M-148 and A.S.T.M. C309. The material shall be equal to Sonneborn Kur-N-Seal, Masterseal (by Master Builders), or Clear Seal (by W.R. Grace).

2.07 NON-SHRINK GROUT

A. Non-shrink, non-metallic grout for use beneath column base plates shall be premixed, factory packaged, non-staining, non-metallic, non-gasing mortar grouting compound, conforming to ASTM C1107, "Standard Specification for packaged Dry, Hydraulic-Cement Grout (Non-shrink)." In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout when placed at a fluid consistency shall achieve 95% bearing under a 4' X 4' base plate. The non-shrink grout shall be "Euco NS" by the Euclid Chemical Co., "Masterflow 713" by Master Builders, or approved equal.

2.08 BONDING AND REPAIR MATERIALS

A. Bonding Compounds: The compound shall be a polyvinyl acetate type, Rewettable: "Euco Weld" by the Euclid Chemical Co. or "Weldcrete" by the Larsen Co. Use only in areas not subject to moisture. Non-Rewettable, Polymer modified bonding compound: "Euco-Bond" by the Euclid Chemical Company or approved equal.

B. Epoxy Adhesive: The compound shall be a two (2) component, 100% solids, 100% reactive compound suitable for use on dry or damp surfaces, "Euco Epoxy No. 452MV or No. 620" by the Euclid Chemical Co. or "Sikadure Hi-Mod" by the Sika Chemical Corp.

PART 3 - EXECUTION

3.01 PROPORTIONING CONCRETE

A. Admixture other than air-entraining shall not be used without written approval of Architect. See Paragraph 2.02 of this section.

B. Ready mixed concrete shall be used. It shall comply with applicable provision of A.S.T.M. C94 and as specified herein.

C. Batching system shall be automatic and shall record each material as batched prior to discharge into mixer and zero referenced following discharge. This record shall be marked to permanently identify each batch.

D. Equipment shall be provided to continuously determine surface moisture in the fine aggregate. Moisture corrections shall be made without use of calculations by the batcher.

E. The determination of the proportions of cement, aggregate, water and approved admixtures to attain the required strength shall be made by one of the following methods approved by the Architect. Under no circumstances shall Method II be used, when the established coefficient of variation is greater than 15.

F. Method I: Trial Mixtures

1. Requirements For

Min. 28 day compressive strength (psi)	4000
Max. size coarse aggregate (inches)	1.0
Min. cement content (lb. per cu. yd.)	564
Max. water-cement ratio	0.50
Max. slump (inches)	5.0
Min. slump (inches)	3.0
Air content (% by volume) +/- 1.0%	4.5

For interior slab on grade, no air added

2. Prior to delivery of concrete to job, Architect shall be furnished mix designs and at least ten consecutive test reports, made within the last six months, to substantiate strength-producing properties of the proposed mix design. If such data is not available, the mix design shall be certified by a recognized testing laboratory to produce specified results.

G. Method II: Field Experience

1. Requirements For

Min. 28 day compressive strength (psi)	4000
Max. size coarse aggregate (inches)	1.0
Max. slump (inches)	5.0
Min. slump (inches)	3.0
Air content (% by volume) +/- 1.0%	4.5

For interior slab on grade, no air added

2. Prior to delivery of concrete to job, the Architect shall be furnished a certified statement establishing the standard deviation of the plant. At least fifteen consecutive test reports based on the proposed mix design and made within the last six months shall be furnished the Architect to substantiate the strength-producing properties of the proposed mix design.

H. No water may be added to any concrete if it falls within the guideline specified. . A minimal amount of water may only be added if slump is extremely low and the delivery ticket indicates

a water under-run for the batch. The contractor ultimately decides if the concrete strength will be impaired or not.

3.02 CONVEYING AND DEPOSITING

A. Concrete shall be conveyed and placed in accordance with ACI 304. It shall be deposited as early as practicable, in its final position. Methods used shall not cause separation of materials.

B. Forms shall be free of ice, water and debris before concrete is placed.

C. Only clean equipment, free of hardened concrete and foreign material, shall be used for conveyance.

D. Placing shall proceed as continuous operation until unit of construction is complete.

E. Concrete placed in forms shall be consolidated by mechanical vibration. Vibrator shall deliver 10,000 vibrations per minute and shall be inserted into each 18" lift at intervals not to exceed 12". Vibrator shall run for minimum of 8 seconds after complete submersion.

3.03 CURING AND PROTECTION

A. Immediately after completion of final placing and/or finishing operation all concrete surfaces shall be protected from defacing of any nature and shall be maintained in moist condition for a period of five (5) days.

B. Curing methods must be approved by the Architect before concreting is begun.

C. Curing Methods: Perform curing of concrete by moist curing, by moisture-retaining cover curing, by curing compound, and by combinations thereof, as herein specified. Note: Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete (liquid floor hardener, waterproofing, damp-proofing, membrane roofing, flooring, painting, and other coatings and finish materials), unless otherwise acceptable to Architect, and written documentation is provided by coating manufacturer.

D. Provide moisture curing by following methods:
1. Keep concrete surface continuously wet by covering with water or continuous water-fog spray.
2. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.

E. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

F. Provide curing compound to slabs where indicated, or where permissible as described herein, as follows: Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during period.
1. Curing Formed Surfaces: Cure formed concrete surfaces, similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

2. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by application of appropriate curing compound.

G. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

3.04 COLD WEATHER REQUIREMENTS

A. Temperature of concrete when placed shall be not less than 50 deg. F.

B. Temperature of concrete shall be maintained above 50 deg. F. and below 90 deg. 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.

3.05 HOT WEATHER REQUIREMENTS

A. Temperature of concrete when placed shall be less than 90 deg. F.

B. All concrete shall be placed within 90 minutes of batch time. Shorter time limits may apply when air temperature is in excess of 90 deg. F.

C. Procedures shall be in accordance with ACI 305.

3.06 GENERAL FORMWORK

A. Forms shall conform to shape, lines and dimensions of members as indicated, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be properly braced or tied together so as to maintain position and shapes and insure safety to workmen or passersby. Forms for smooth exposed surfaces shall be constructed of Plywood or other approved smooth material. All plywood forms shall be new at the beginning of the job. Exposed concrete corners shall be beveled 3/4 inch unless otherwise noted.

B. Form coatings, when required, shall be non-staining and shall be applied before reinforcing steel is placed. Temporary openings for cleaning and inspection shall be provided at base of vertical forms and other places when necessary.

C. It is the intent of this specification that all form removal be done in such manner and at such time as to not damage the concrete surfaces and to insure complete safety to the structure. The contractor shall be responsible for safe practice in this regard.

D. Design, installation, and removal of formwork shall conform to the requirements of ACI 347.

3.07 INSTALLATION OF ANCHORAGE ITEMS AND JOINTS

A. Joints not shown in the contract documents shall be so made and located as to least impair the strength of the structure and shall be approved by the Architect/Engineer.

B. All reinforcement shall be continued across joints. Keys shall be provided as directed by the Architect/Engineer.

C. Anchor bolts furnished under Section 05120 shall be set in accordance with the setting plan furnished under Paragraph 1.03-B-4 of Section 05120.

D. It shall be the responsibility of the contractor under this section to coordinate and place all cast-in-place anchorage items related to anchoring wall system. Anchorage items shall be located as shown on plans.

E. Dovetail slots and other embedded items shall be provided as required for support of other

work that is attached to or supported by cast-in-place concrete. Spacing of dovetail slots shall not exceed 24" on center.

3.08 REINFORCING

A. Detailing, fabrication and placing shall conform to ACI 315 and/or ACI 318.

B. Shop drawings shall be checked by the contractor and submitted to the Architect for review in conformance with "Special Provisions" before fabrication is begun.

3.09 CONCRETE TESTING

A. Test to determine quality of concrete shall be paid for by the Contractor.

B. Each class of concrete shall be represented by at least five tests. Not less than one test shall be made each 50 cu. yds. but there shall be at least one test for each day's concreting unless otherwise directed by Architect. Laboratory shall record and report location within project of concrete tested.

C. A test shall consist of the following:

Selection and securing of samples ..... A.S.T.M. C172
Air content* ..... A.S.T.M. C231 or A.S.T.M. C173
Slump Test* ..... A.S.T.M. C143
Cylinders - Four - 6" x 12" ..... A.S.T.M. C31
Cylinder Test* ..... A.S.T.M. C39
*Results to be reported by laboratory on test reports.

D. One cylinder shall be tested at 7 days for information and two cylinders shall be tested at 28 days for acceptance. One cylinder shall be kept in reserve for 56-day test if needed. Reports of 7, 28, and 56-day strength tests shall be made directly by laboratory as follows:

One copy to Owner
Two copies to Architect
One copy to Structural Engineer
One copy to Contractor
One copy to R/M Producer

E. The strength level shall be considered satisfactory so long as the average of all sets of three (3) consecutive strength test results equal or exceed the specified f'c and no individual strength test result falls below the specified strength f'c by more than 500 psi.

F. In event test results do not meet specification requirements, one or more of the following will be required at no cost to owner:
1. Windsor Probe test conforming to A.S.T.M. C803
2. Core-boring test conforming to A.S.T.M. C42
3. Load test in accordance with Chapter 20, ACI 318-95

G. In event Windsor Probe, core-boring, or load test indicate that concrete does not conform to specifications, contractor shall take such measures as Architect shall prescribe or shall remove defective work as directed by Architect.

H. Test made for contractor's convenience, to determine when concrete can be placed in service or stripped, shall be paid for by contractor. Such tests shall be made in accordance with A.S.T.M. C31 and cured in the field as directed by the Architect.

3.10 FINISHING HORIZONTAL SURFACES

A. Under no circumstances shall dry cement or mixture of cement and sand be used to absorb surface moisture or to stiffen surface to be finished.

B. Floor Flatness/Levelness Tolerance: F_F 35/ F_L 25 (minimum local value F_F 25/ F_L 15). Measured according to ASTM E1155. Floor tolerance compliance testing shall be provided by the Owner and performed by an Independent Testing Agency acceptable to the Architect. Testing shall be in accordance with ASTM E1155 and performed within 24 hours after placement and reported to the Architect no later than 72 hours after installation. All tests shall be conducted before forms, including edge forms, have been removed.

C. Finish of concrete surfaces shall be as indicated on the drawings and room finish schedule.

D. Broom Finish: After concrete has been placed, surface shall be brought to established grade with straightedge and bull floated to "Smooth Out" surface. When water sheen has disappeared, surface shall be floated with power and/or wood floats. After floating, surface shall be broomed to achieve surface texture approved by Architect.

E. Hard Trowel Finish: After concrete has been placed, surface shall be brought to established grade, with straightedge and bull floated to "Smooth Out" surface. When water sheen has disappeared, surface shall be finished with power operated trowel and/or hand trowel until smooth hard surface is obtained free of pin holes and other imperfections.

F. Curing Compound: Surfaces to be treated as indicated on plans or called for in room schedule shall be prepared and the curing compound applied in strict accordance with the manufacturer's recommendations and as specified herein.

Application of curing compound shall be deferred until all other work that might cause damage to the surface has been completed. The curing compound shall be applied in 2 coats so that minimum coverage is not more than 450 square feet per gallon of material per coat.

3.11 REPAIRING AND PATCHING

A. Tie holes and repairable defective areas shall be patched immediately after form removal.

B. Patching mixture shall be made of same material and of approximately same proportions as used for concrete, except that coarse aggregate shall be omitted and mortar shall consist of not more than one part cement to 2 1/2 parts sand by damp loose volume. White Portland cement shall be substituted for part of Gray Portland cement on exposed concrete in order to produce color matching color of surrounding concrete, as determined by trial patch. Remove all fins, form offset marks and other imperfections that would present an unsightly appearance.

3.12 FINISHING EXPOSED CONCRETE SURFACES

A. Surfaces that will be exposed in the finished structure other than those under 3.10 shall have fins removed and repairable defective areas patched. See Paragraph 3.06 for formwork requirements. Patching procedures shall be as specified in paragraph 3.11 of this Section.

(SEE EXHIBIT "A" NEXT PAGE)

EXHIBIT "A"

PROJECT NAME: _____

PROJECT LOCATION: _____

GENERAL CONTRACTOR: _____

CONCRETE SUPPLIER: _____

ADDRESS: _____

TYPE PLANT: CENTRAL MIX ( ) TRANSIT MIX ( )
AUTOMATIC ( ) SEMIAUTOMATIC ( ) MANUAL ( )

ESTIMATED HAUL DISTANCE: _____ MILES

ESTIMATED HAUL TIME: _____ MINUTES

CEMENT SOURCE: _____

F. A. SOURCE: _____

C. A. SOURCE: _____

DATE SCALES LAST TESTED: _____

METHOD OF PROPORTIONING MIX: PRESCRIPTION ( ) PERFORMANCE ( )

CONCRETE TESTING:

NAME OF LAB: _____

ADDRESS OF LAB: _____

HAS LAB PERSONNEL READ CONCRETE SPECIFICATION? YES ( ) NO ( )

WHO WILL MOLD CYLINDERS AND PERFORM OTHER SPECIFIED TESTS?
CONTRACTOR PERSONNEL ( ) TESTING LAB PERSONNEL ( )

IF BY CONTRACTOR PERSONNEL, IS PERSON FAMILIAR WITH SPECIFIED
A.S.T.M. REQUIREMENTS FOR TEST? YES ( ) NO ( )

TEST CYLINDERS WILL BE TRANSPORTED FROM FIELD TO LABORATORY BY:
CONTRACTOR ( ) TESTING LABORATORY ( ) OTHER ( )

IF BY OTHER ... NAME _____

SECTION 03350 – CONCRETE FINISHING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Single application cure-sealer-hardener for new concrete floors.

B. Single application sealer-hardener for existing concrete floors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 03300 – Cast-In-Place Concrete

1.03 REFERENCES

A. ASTM International (ASTM):

1. ASTM C39 Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
2. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces.
3. ASTM C805 Standard Test Method for Rebound Number of Hardened Concrete.
4. ASTM C1028 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method.
5. ASTM D3359 Standard Test Methods for Measuring Adhesion by Tape Test.
6. ASTM G23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials (Withdrawn 2000).

1.04 SUBMITTALS

A. Manufacturer's literature, installation instructions, and maintenance data.

B. Materials Safety and Data Sheets.

C. Maintenance Data: Maintenance instructions, including precautions for avoiding staining after application.

1.05 QUALITY ASSURANCE

A. All work must be performed by an applicator certified by the manufacturer. Certification credentials are required.

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

B. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

C. Handling: Protect materials from dirt, corrosion, oil, grease and other contaminants.

PART 2 – PRODUCTS

2.01 MATERIAL

A. Manufacturer:

1. "Curecrete Distribution, Inc."

Telephone: (800) 998-5664; website: http:// www.ashfordformula.com.

B. Cure-Sealer-Hardener: Ashford Formula, a water-based chemically reactive penetrating sealer and hardener that seals by densifying concrete so that water molecules cannot pass through but air and water vapor can, and allows concrete to achieve full compressive strength, minimizing surface crazing and eliminating dusting.

1. Abrasion Resistance to Revolving Disks: At least a 32.5% improvement over untreated samples when tested in accordance with ASTM C779.
2. Surface Adhesion: At least a 22% increase in adhesion for epoxy when tested in accordance with ASTM D3359.
3. Hardening: As follows when tested in accordance with ASTM C39:
   a. After 7 Days: An increase of at least 40% over untreated samples.
   b. After 28 Days: An increase of at least 38% over untreated samples.
4. Coefficient of Friction: 0.86 dry, 0.69 wet when tested in accordance with ASTM C1028.
5. Rebound Number: An increase of at least 13.3% over untreated samples when tested in accordance with ASTM C805.
6. Light Exposure Degradation: No evidence of adverse effects on treated samples when tested in accordance with ASTM G23.

PART 3 – EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.02 EXAMINATION

A. Do not begin installation until substrates have been properly prepared and are suitable for application of product.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.03 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Do not use frozen material. Thaw and agitate prior to use.

D. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid or other liquids.

3.04 INSTALLATION

A. New Concrete: Apply cure-seal-hardener to new concrete as soon as the concrete is firm

enough to work on after troweling; with colored concrete, wait a minimum of 30 days before application.

1. Spray on at rate of 200 ft^2/gal (5 m^2/L).
2. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 minutes without allowing it to dry out or become slippery. In hot weather, slipperiness may appear before the 30 minute time period has elapsed. If that occurs, apply additional cure-seal-hardener as needed to keep the entire surface in a non-slippery state for the first 15 minutes. For the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state. In hot weather conditions, follow manufacturer's special application procedures.
3. When the treated surface becomes slippery after this period, lightly mist with water until slipperiness disappears.
4. Wait for surface to become slippery again, and then flush entire surface with water to remove all cure-seal-hardener residue.
5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.
6. Wet vacuum or scrubbing machines can be used in accordance with manufacturer's instructions to remove residue.

B. Existing Concrete: Apply cure-seal-hardener only to clean bare concrete.

1. Thoroughly remove previous treatments, laitance, oil and other contaminants.
2. Saturate surface with cure-seal-hardener; re-spray or broom excess onto dry spots.
3. Keep surface wet with cure-seal-hardener for a minimum soak-in period of 30 - 40 minutes.
4. If most of the material has been absorbed after the 30 minute soak-in period, remove all excess material, especially from low spots, using broom or squeegee.
5. If most of the material remains on the surface after the 30 minute soak-in period, wait until the surface becomes slippery and then flush with water, removing all cure-seal-hardener residue. Squeegee completely dry, flushing any remaining slippery areas until no residue remains.
6. If water is not available, remove residue using squeegee.

3.05 PROTECTION

A. Protect installed floors for at least 3 months until chemical reaction process is complete.

1. Do not allow traffic on floors for 3 hours after application.
2. Do not allow parking of vehicles on concrete slab.
3. If vehicles must be temporarily parked on slab, place dropcloths under vehicles during entire time parked.
4. Do not allow pipe cutting using pipe cutting machinery on concrete slab.
5. Do not allow temporary placement and storage of steel members on concrete slabs.
6. Clean up spills immediately and spot-treat stains with degreaser or oil emulsifier.
7. Clean floor regularly in accordance with manufacturer's recommendations.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Material Safety and Data Sheets.
3. Maintenance Data.

END OF SECTION 03350

SECTION 04100 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 04150 - Masonry Accessories
Section 04160 - Masonry Reinforcement
Section 04210 - Face Brick Masonry
Section 04220 - Concrete Unit Masonry
Section 04222 – Concrete Unit Masonry Acoustical Units
Section 04230 – Reinforced Unit Masonry
Section 04430 - Limestone
Section 04510 - Masonry Protection and Cleaning

1.03 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).

1.04 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.

1.05 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: (Storage Building Only)
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. No chemical admixtures shall be added to the mortar without the express permission of the Architect.

D. 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. (Storage Building Only)

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 04100

SECTION 04150 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 04100 - Mortar
Section 04160 - Masonry Reinforcement
Section 04210 - Face Brick Masonry
Section 04220 - Concrete Unit Masonry
Section 04230 – Reinforced Unit Masonry
Section 04430 - Limestone
Section 04510 - Masonry Protection and Cleaning

1.03 DELIVERY, STORAGE AND HANDLING

A. Storage: Store steel accessories off of the ground, on blocking, with waterproof cover.

1.04 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.).

1.05 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 block masonry back-up (with continuous insulation): See 04160 – Masonary Reinforcement
   a. Provide one of the following approved products:
      1) "Heckman Building Products", Pos-I-Tie wire ties with "Tapcon" screws.
   b. Length as required by manufacturer for full extension into substrate material.
   c. Hot dipped galvanized, typical.
   d. Stainless steel, type 304, at stone veneer.

D. Stone Anchors:
1. Provide one of the following approved products:
   a. "H&B", #303 corrugated veneer tie and #305 dovetail slot.
2. 2-piece dovetail design comprised of continuous dovetail slot and corrugated masonry tie.
3. Stainless steel, type 304.

E. Column Anchors:
1. Provide one of the following approved products:
   a. "H&B", #359-FH Weld-On Tie with #302W Column Web Tie.
2. Hot dipped galvanized.

F. Beam Anchors:
1. Provide one of the following approved products:
   a. "H&B", #357.
2. Hot dipped galvanized.

G. 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.

H. 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.

I. 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 04150

SECTION 04160 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 04150 - Masonry Accessories
Section 04220 - Concrete Unit Masonry

1.03 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.

1.04 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.

1.05 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.

D. Provide one of the following approved products for multi-wythe non-adjustable systems:
1. "H&B", #130, Truss-Tri-Mesh.

E. Provide one of the following approved products for multi-wythe adjustable systems:
1. "H&B", #170, Truss Lox-All Adjustable Eye-Wire.

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 04160

SECTION 04210 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 01210 - Cash Allowances
Section 04100 - Mortar
Section 04150 - Masonry Accessories
Section 04160 - Masonry Reinforcement
Section 04220 – Concrete Unit Masonry
Section 04230 – Reinforced Unit Masonry
Section 04510 - Masonry Protection & Cleaning
Section 07650 - Flexible Flashing

1.03 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.

1.04 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.

1.05 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. Size:
1. Typical standard Modular units: 8 inches long x 2-1/4 inches high x not less than 3-5/8 inches deep.
2. Utility size units: 11-5/8 inches long x 3-5/8 inches high x not less than 3-5/8 inches deep.

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.

F. See cash allowance for brick.

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 04150 - 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 07900-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 04210

SECTION 04211 – PERMEABLE BRICK PAVERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete brick paver work as shown on drawings and specified herein.

B. Geotextile fabric for soil stabilization, soil separation, weed barrier, or moisture barrier is specified in Section 02200 – Earthwork.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 02200 – Earthwork
Section 03300 – Cast-In-Place Concrete

1.03 QUALITY ASSURANCE

A. Qualifications:
1. Employ landscapers skilled and experienced in the setting of permiable brick pavers.
2. Only first-class brick paver work will be accepted.

B. Mock-Up Panel:
1. Construct on site sample panel 1'-4" wide x 1'-4" long.
2. Show proposed color range, texture, bond, sand joint, spacing, and workmanship of materials.
3. Do not proceed with paver work until sample panel has been approved.
4. Use panel as standard of comparison for all paver work.
5. Do not destroy or remove panel until all paver work is complete and accepted.

1.04 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. Brick submitted shall conform to these specifications and be within color and texture range specified.
3. Selected brick samples shall have mock-up panels constructed for final selection and approval.
4. Lay additional sample panels as directed by Architect
5. Architect reserves the right to select any brick from any supplier.

B. Test reports indicating compressive strength, water absorption, resistance to freeze-thaw, and abrasion resistance.

1.05 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.

C. Band with rust resistant bands.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. Provide one of the following acceptable systems:
   1. "HYDRABRIC II – STORMLOCK PERMEABLE PAVERS"; Reading Rock.

B. Brick Layout:
   1. Size: 8" X 3.76" X 3.15"
   2. Layout: Herringbone
   3. Color: Architect select from full line of manufacturers colors.

C. Special Shapes:
   1. Cut standard unit with power saw or provide units manufactured to sizes or shape required.
   2. Special shape items to match selected brick in every other respect.

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.

F. Performance Criteria:
   1. Vehicular traffic applications:
   2. Slip resistance shall be tested in general accordance with ASTM C 1028-96, standard test method for determining the static coefficient of friction of ceramic tile and other like surfaces by the horizontal dynamometer pull-meter test. Minimum static coefficient of friction shall be .60 for wet and .70 for dry, for all applications.
   3. Mechanically installed.
   4. 8,000 psi per ASTM standards.
   5. 9.57% void ratio or greater.
   6. Inhibits vegetation growth.
   7. Withstands Freeze-Thaw.
   8. ADA compliant.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify initial absorption rate of brick is within acceptable limits of manufacturer.

B. Reduce initial absorption exceeding acceptable limits of manufacturer by thoroughly wetting with clean water 24 hours prior to placement as directed by the manufacturer.

C. Prepare subgrade and base beneath paver section per detail on drawings and as required to properly set paver system atop.

3.02 INSTALLATION

A. General:
   1. Lay brick plumb and true to lines.
   2. Cut brick as required for size and configuration with masonry saw.

B. Allowable Tolerances:
   1. Joint widths to be no greater than 5/32 of an inch and not less than 1/16 of an inch.
   2. Pavers shall not be directly touching each other unless they have spacing bars.

C. Joint Treatment:

1. Sweep dry sand into the joints after the pavers have been set in place until joints are flush with top surface.
2. Fog lightly with water.
3. Repeat process until joints are full.

D. Leveling:
   1. Protect newly laid pavers with plywood or carpeting as the work progresses.
   2. If additional leveling is required, you must protect the surface to avoid chipping.

SUBMITTAL CHECK LIST

1. Brick Samples.
2. Test Reports.
3. Mock-up Panel.

END OF SECTION 04211

SECTION 04220 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 04100 - Mortar
Section 04150 - Masonry Accessories
Section 04160 - Masonry Reinforcement
Section 04222 – Concrete Unit Masonry Acoustical Units
Section 04230 – Reinforced Unit Masonry
Section 04510 - Masonry Protection and Cleaning
Section 07650 - Flexible Flashing

1.03 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.

1.04 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: (See Section 04230 – Reinforced Unit Masonry)

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. “L. Thorn Brick and Block”; Custom Architectural Masonry Units.
4. “Masolite”; Concrete Masonry Units.

2.02 INTEGRALLY-COLORED CONCRETE MASONRY UNITS (CMU) (Storage Building)

A. Provide one of the following approved products:
1. “4D/Schuster’s (Oldcastle)”; Integrally-Colored, Custom Architectural Masonry Units.
2. “General Shale”; Integrally-Colored, Custom Architectural Masonry Units.
3. “L. Thorn Brick and Block”; Integrally-Colored, Custom Architectural Masonry Units.

B. Integrally-colored through entire body of masonry units.

C. All other requirements of “Concrete Masonry Units (CMU)” also apply as specified herein.

2.03 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.

2.04 MORTAR

A. See Specification Section 04100 - Mortar.

2.05 STEEL REINFORCEMENT

A. See Specification Section 04160 - 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. Stack bond on all exposed walls, unless otherwise indicated.
   2. Running bond allowed where unexposed.

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 04220

SECTION 04222 - CONCRETE UNIT MASONRY ACOUSTICAL UNITS

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

Section 04100 - Mortar
Section 04150 - Masonry Accessories
Section 04220 - Concrete Unit Masonry
Section 04230 – Reinforced Unit Masonry
Section 04250 - Masonry Reinforcement
Section 04510 - Masonry Protection and Cleaning
Section 07650 - Flexible Flashing

1.02 REFERENCES

A. American Society of Testing and Materials
   1. ASTM C 423 - Standard Test Method of Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   2. ASTM E 90 - Standard Method of Laboratory measurement of Airborne Sound Transmission Loss of Building Partitions.
   3. ASTM E 413 - Standard Classification for Determination of Sound Transmission Class.
   4. ASTM E 795 - Standard practices for Mounting Test Specimens During Absorption Tests.
   5. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   6. ASTM E 699 - Standard Practice Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E-6.

B. American National Standards Institute/national Fire Protection Agency.
   1. ANSI/NFPA 101 - Life Safety Code.
   2. ANSI/NFPA 251 - Standard Methods of Fire Tests of Building Construction and Materials.
   3. ANSI/NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

1.03 QUALITY ASSURANCE

A. To qualify for acceptance, and independent testing agency must demonstrate to the Architect's satisfaction, based on the evaluation of agency submitted criteria conforming to ASTM E 699, that is has the experience and capability to conduct satisfactorily the testing indicated.

B. Provide acoustical diffusors with surface burning characteristics as indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, as per ASTM E 84 and ANSI/NFPA 255 by a testing and inspecting agency acceptable to authorities having jurisdiction.
   1. Flame Spread: 25 or less.
   2. Smoke Developed: 450 or less.

C. Manufacturer of the specified product herein shall have a minimum of 10 years successful experience with work comparable to Work of this Project.

D. Obtain acoustical diffusors and absorptive wall panels from a single source with resources to provide products of consistent quality in appearance and physical properties.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver acoustical diffusors and absorptive wall panels in manufacturer's original unopened packages and/or containers, with labels intact.

B. Store all components to provide suitable protection against deleterious effects from exposure to moisture, direct sunlight, extreme heat or cold, and nay other conditions which may damage materials.

C. Handle all components to preclude damage. Take special precaution to prevent damage to edges and corners of acoustical diffusors and absorptive panels.

1.05 PROJECT CONDITIONS

A. Cover walls each day after installation to keep open wall protected and dry.

PART 2 - PRODUCTS

2.01 ACOUSTICAL CONCRETE DIFFUSER BLOCK MASONRY

A. Type "A" and "B" units arranged to provide the 7 quadratic residue theory sequence, located in Apparatus Room.

B. The Acoustical Concrete Diffuser Block Masonry shall be the model DiffusorBlox as manufactured by a licensed dealer of RPG Diffusor Systems, Inc. The Indiana Dealer is:

CSR Masolite
2200 Lafontain Street
Fort Wayne, IN 46801
(219) 432-3568

C. The acoustical concrete masonry block shall conform to the following:

1. For hollow load bearing units, ASTM C-90 for Grade N, Type I or Type II units, with the exceptions noted herein.
2. For hollow non-load bearing units, ASTM C-129 for Grade N, Type 1 or Type II units, with the exceptions noted herein.
3. DiffusorBlox constituent materials shall conform to the following ASTM specifications.
   a. Portland Cement - ASTM C-150
   b. Blended Cements - ASTM C-595
   c. Hydrated Lime, Type S - ASTM C-207
   d. Pozzolans - ASTM C-618
   e. Aggregate - ASTM C-331 or C-33, based on local availability.

D. The acoustical concrete masonry unit shall work on the one dimensional reflection phase grating principle, using an array of wells of equal width separated by dividers. The depths of the wells shall be based on the prime 7 quadratic residue theory sequence. A full sequence is achieved by alternating two types of block designated as Type A and Type B.

E. Where fire rated assemblies are indicated, materials shall be tested by an independent, accredited NVLAP facility according to the test methods as defined by ASTM E 119 and NFPA 251.

F. Inset insulation shall be semi-rigid fiberglass conforming to ASTM C 1071, having 6.0 lb./ft 3 density, and a Class A fire rating, each individually shaped to conform to the concrete block cores. Fiberglass inserts shall be pre-installed at the block plant prior to delivery.

G. The overall dimensions shall be 7-5/8" (H) x 15-5/8" (W) x 7-5/8" (D) or 11-5/8" (D).

PART 3 - EXECUTION

3.01 PREPARATION

A. Do not install materials over unfinished plywood, raw wood furring, or other surfaces which expand and contract with changes in weather, temperature and relative humidity.

B. Surface to receive materials shall be free of oils, form residue, dust or any other substances that may be detrimental to the installation of product.

C. Prior to the installation of the acoustical diffusor, allow product to stabilize to the current environment for a period of not less than 24 hours.

3.02 INSTALLATION

A. Install materials in strict accordance with manufacturer's recommendations.

B. Install acoustical diffusors in locations indicated on the drawings with vertical surfaces and edges plumb, top edges level and in alignment with other panels, scribed to fit adjoining work accurately at borders and penetrations.

3.03 CLEANING

A. Remove debris which may have been caused during the installation of this work.

END OF SECTION 04220

SECTION 04230 - REINFORCED UNIT MASONRY

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.

B. This section includes furnishing all labor, tools, materials, equipment and services necessary to properly place and complete all reinforced unit masonry work, including reinforcing steel and other necessary items indicated and/or specified herein or shown on the drawings.

1.02 RELATED WORK

A. Requirements of Section "UNIT MASONRY" apply to work of this section.

1.03 RELATED DOCUMENTS

A. Comply with the provisions of the latest editions of the following Codes, Specifications and Standards, except as otherwise shown or specified herein.

1. ACI 530-05/ASCE 5-05/TMS 402-05 Building Code Requirements for Masonry Structures.
2. ACI 530.1-05/ASCE 6-05/TMS 602-05 Specifications for Masonry Structures.
3. NCMA "Specification for the Design and Construction of Load-Bearing Concrete Masonry."
4. Materials shall comply with requirements of designated specifications of American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania.

PART 2 - PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete masonry units used throughout the work shall be obtained from one manufacturer. Standard-sized units with nominal dimensions of 16 inches long by 8 inches high shall be used. Thickness of units shall be as indicated on drawings.

B. Reinforced hollow load-bearing CMU shall be Grade N-II units conforming to ASTM C90-93. Minimum Compressive Strength required for units shall be 2000psi on the NET AREA of the units and 1000psi on the GROSS AREA. Lightweight units (103 lbs. per cu. ft., oven dry wt. of concrete) shall be used.

C. Provide special shapes, where required, for lintels, bond beams, pilasters, headers and other special conditions.

2.02 MORTAR

A. Mortar for reinforced masonry shall be Type S, with minimum compressive cube strength of 1800psi when tested in accordance with ASTM C270.

B. Portland Cement, Type 1, meeting the requirements of ASTM C150.

C. Masonry Cement: ASTM C 91

D. Hydrated lime: ASTM C207.

E. Aggregates for mortar shall comply with ASTM C144.

F. Water shall be clean, fresh and potable.

G. No chemical admixture shall be added to the mortar.

2.03 GROUT

A. Grout for reinforced masonry shall have a minimum 28-day compressive strength of 2500psi and shall comply with ASTM C476.

B. Portland Cement, Type 1, meeting the requirements of ASTM C150.

C. Fine aggregates for grout shall comply with ASTM C404.

D. Coarse aggregates for grout shall be pea gravel.

E. Water shall be clean, fresh and potable.

2.04 METAL REINFORCEMENT

A. Provide deformed bars of the size indicated on the drawings of the following grades:
1. Stirrups and column ties: ASTM A615, Grade 60.
2. All other reinforcement: ASTM A615, Grade 60.

2.05 HORIZONTAL JOINT REINFORCING

A. Provide welded wire units, prefabricated in lengths of not less than 10 feet, with matching corner ("L") and intersection ("T") units. Fabricate from cold-drawn steel wire complying with ASTM A82, with deformed continuous side rods and plain cross rods, placed in a truss-type configuration.

B. Wire for side rods and cross-rods shall as noted on the contract drawings.

C. Metal accessories, including spacers, chairs, ties and other devices necessary for properly assembling, placing, spacing and supporting all reinforcement in place shall be provided.

PART 3 - EXECUTION

3.01 GENERAL

A. Build masonry construction to the full thickness shown, except build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. 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.

C. DO NOT WET concrete masonry units.

D. Lay all reinforced masonry in running bond pattern. Bond and interlock each course of each wythe at corners, unless otherwise shown.

E. Lay up walls plumb and with courses level, accurately spaced and coordinated with other work.

F. Lay CMU units with full face-shell mortar beds. 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. Solidly bed cross-webs of starting courses in mortar. Provide 3/8" joints unless otherwise shown.

. 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.

H. Where bond beams are shown, use special units or modify regular units to allow for placement of continuous horizontal reinforcing bars. 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.

I Lay wall and pilaster units together to maximum pour height shown. Pilaster units shall provide minimum clearances and grout coverage for number and size of vertical reinforcement shown.

3.02 GROUTING

A. Contractor may use either low-lift or high-lift grouting techniques, subject to the following requirements.

B. LOW LIFT GROUTING

1. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear, unobstructed continuous vertical cell measuring not less than 2" by 3".
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.
4. In grouting vertical cells, stop grout 1-1/2" 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 structural members supporting masonry to ensure bond.

C. HIGH-LIFT GROUTING

1. Paragraphs 1,3,4,5,6,7, and 8 under "Low-Lift Grouting" apply to this section.
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.
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.
6. Provide inspection holes at top of foundation wall and repair after grouting is complete.

D. As the work progresses, built-in items specified under this and other sections shall be installed.

3.03 PLACING REINFORCEMENT

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" (whichever is greater).

C. 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", whichever is greater. Provide lateral ties as shown.

D. Splice reinforcing bars where shown; do not splice at other points unless approved. Provide lapped splices unless otherwise indicated. In splicing vertical bars or attaching to dowels, lap ends, place bars in contact and tie with wire.

E. Horizontal joint reinforcing shall be placed in every course of the masonry work (8 inches on center) unless noted otherwise.

3.04 FORMWORK

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.

3.05 REPAIR, POINTING AND CLEANING

A. Remove and replace masonry units which are loose, chipped, broken or otherwise damaged. Provide new units to match adjoining units, and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

B. 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.

C. 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.

3.06 TESTING AND FIELD QUALITY CONTROL

A. The Contractor will retain a qualified independent testing agency to perform the following testing for field quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor’s expense.

B. Testing Frequency: Tests and evaluations listed in this section for mortar and grout shall be performed prior to construction and during construction for each 1000 sq. ft. of wall area or portion thereof, unless noted otherwise.

C. Mortar composition and properties shall be evaluated per ASTM C 780.

D. Grout shall be sampled and tested for compressive strength per ASTM C 1019. One test shall be performed for each 1000 sq. ft. of wall area or each grout lift, whichever is more frequent.

END OF SECTION 04230

SECTION 04430 - LIMESTONE

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish labor, materials, equipment, special tools, supervision and services required to furnish and install all cut limestone indicated, noted and detailed on the drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 03300 - Cast-in-Place Concrete
Section 04100 – Mortar
Section 04222 – Concrete Unit Masonry Acoustical Units
Section 04230 – Reinforced Unit Masonry
Section 04510 - Masonry Protection and Cleaning
Section 07900 - Joint Sealers

1.03 QUALITY ASSURANCE

A. Comply with Industry Standards and Practices as set forth by the Indiana Limestone Institute of America, Inc.

1.04 REFERENCES

A. Publications of the following institutes, associations, societies, and agencies are referred to is this Section.
   1. American Society for Testing and Materials (ASTM).
   2. Indiana Limestone Institute of America, Inc. (ILI).

B. Fabricator shall be an established firm regularly engaged in the fabrication of limestone. Fabricator shall have adequate equipment and qualified personnel to fabricate quality stone products and have past experience in the fabrication of limestone for projects of a similar nature.

C. Quarrier and fabricator of the stone shall be a member in good standing of the Indiana Limestone Institute of America, Inc.

1.05 SUBMITTALS

A. Furnish for approval by the Architect, complete cutting and setting drawings for all cut stone work.
   1. Show in detail the sizes, sections and dimensions of stone, the arrangement of joints and bonding, anchoring and other necessary details.
   2. Strictly follow all jointing shown by the Architect on contract drawings, unless modifications are agreed upon in writing or indicated upon the approved Shop Drawings.
   3. If the contract drawings do not show the intent of the jointing, it will be the fabricator=s responsibility to establish the jointing in accordance with industry standards and practices.
   4. The general contractor shall furnish all field dimensions necessary for fabrication.
   5. Mark each stone on an unexposed surface and indicate its location with a corresponding mark on the settings drawings.
   6. Clearly indicate on the cutting and setting drawings, all provisions for the anchoring, doweling, and cramping of work, in keeping with standard practices, and for the support of stone by shelf angles and loose steel, etc., when required.

B. Furnish for approval by the Architect, two 12” x 12” samples of the limestone proposed for use in this project. Illustrate color range, texture and finish.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Materials shall conform to the following requirements:
   1. "Stainless and heat resisting chromium-nickel steel plate, sheet, and strip", ASTM designation A167.
   2. "Dimension Limestone", ASTM designation C568.

B. Fabricate dowels, anchors, cramps, dovetails and slots from Type 18-8, 302 stainless steel conforming to ASTM designation A167.

C. Cut stone shall be Indiana Limestone quarried in Lawrence, Monroe or Owen Counties, Indiana.
   1. Grade: Standard.
   2. Color: Natural Buff.
   3. Conform to ASTM designation C568 for category II medium density stone with 4,000 psi compressive strength.

2.02 FABRICATION

A. Cut stone accurately to shade and dimension, full to the square, with jointing as shown on the drawings.
   1. Dress all exposed faces and unless otherwise indicated, beds and joints shall be right angles to the face. Saw or dress backs parallel to face.
   2. Joints unless otherwise indicated shall have a uniform thickness of 3/8 inch.
   3. Cut reglets and drips where indicated on the drawings.
   4. Cut drips under all window and door heads, window sills, water tables, and other projecting courses.
   5. Provide holes and sinkages for anchors and back-check structural work.
   6. Provide lewis holes in stones weighing over 100 pounds and over 3-1/2 inch thick.

2.03 DELIVERY, STORAGE AND HANDLING

A. Carefully pack all cut limestone for transportation, exercising all customary and reasonable precautions against damage in transit.

B. Load and ship stone in sequence with erection and in quantities sufficient with construction phase.

C. Store all stone clear of ground on non-staining skids (cypress, white pine, poplar or yellow pine without excessive amount of resin). DO NOT use preservative treated wood, chestnut, walnut, fir, oak or other woods containing tannin.

D. Cover stone with waterproof paper or polyethylene.

PART 3 - EXECUTION

3.01 SETTING

A. Set all limestone accurately in strict accordance with the contract and shop drawings.

B. When necessary, before setting in the wall, thoroughly clean all exposed stone surfaces by washing with fiber brush and soap powder, followed by a thorough drenching with clear water.

C. Drench all stone joint surfaces not thoroughly wet with clear water just prior to setting.

D. Except as otherwise specially noted, set every stone in full beds of mortar with all vertical joints slushed full. Completely fill all anchor, dowel, and similar holes. All bed and vertical joints shall be 3/8 inch unless otherwise noted.

E. Place lead or plastic setting pads under heavy stones, column drums, etc., in same thickness as joint, and in sufficient quantity to avoid squeezing mortar out. Do not set heavy stones or projecting courses until mortar in courses below has hardened sufficiently to avoid squeezing.

F. Joints can be tooled when initial set has occurred, or raked out 1 inch and pointed later. If pointed with sealant, conform to manufacturer's instructions regarding raked depth and sealant applications.

G. Securely prop or anchor projecting stones until the wall above is set.

H. Embed in mortar only the ends of lugged sills and steps. Leave balance of joint open until finally pointed.

I. All cornice, copings, projecting belt courses, other projecting courses, steps, and platforms (in general, all stone areas either partially or totally horizontal) should be set with unfilled vertical joints. After setting, point or install sealant.

J. In cold weather, follow International Masonry Industry All-Weather Council recommendations for setting from 40° to 20°F, except that no additives are to be used in the setting mortar. Heated enclosures are to be used for work done below 20°F.

K. Coat backs of all stone with cementitious dampproofing, non-staining to exposed stone surfaces.

3.02 CLEANING

A. Wash the stone with fiber brushes, mild soap powder or detergent and clean water or approved mechanical cleaning process.

B. Provide special consideration and protection when brickwork is cleaned above the limestone. Strong acid compounds used for cleaning brick will burn and discolor the limestone.

C. Use of sand blasting, wire brushes or acids will only be permitted under special circumstances, approved by Architect.

3.03 PROTECTION OF FINISHED WORK

A. During construction, carefully cover tops of walls at night, and especially during any precipitation or other inclement weather.

B. Adequately protect walls from dropping at all times.

C. Whenever necessary, place substantial wooden covering to protect the stone work. Use non-staining building paper or membrane under the wood. Maintain all covering until removed to permit final clearing of the stone work.

3.04 CLEANING UP

A. Upon completion, remove all materials, equipment and debris from the premises.

SUBMITTAL CHECK LIST

1. Cutting and Setting Shop Drawings.
2. Samples.

END OF SECTION 04430

SECTION 04510 - 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 RELATED WORK

Section 04100 - Mortar
Section 04210 - Face Brick Masonry
Section 04220 - Concrete Unit Masonry
Section 04222 – Concrete Unit Masonry Acoustical Units
Section 04230 – Reinforced Unit Masonry
Section 04430 - Limestone
Section 04731 - Manufactured Stone Ornaments

1.03 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.

1.04 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. Limestone:
      a. "ProSoCo", Sure Klean #800 Stain Remover.
      b. “EaCo Chem”, NMD 80 (not permitted for polished stone).

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 04510

SECTION 05120 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.

B. This section includes furnishing all structural steel, related materials, labor, tools, equipment and services necessary for the fabrication, delivery to the site, unloading, handling, storing and erecting of all structural steel shown on the drawings, and/or specified herein.

1.02 RELATED DOCUMENTS

A. Comply with the provisions of the latest editions of the following Codes, Specifications and Standards, except as otherwise shown or specified herein.
   1. A.I.S.C. "Code of Standard Practice for Steel Buildings and Bridges."
   2. A.I.S.C. "Specifications for the Design, fabrication and Erection of Structural Steel for Buildings."
   3. A.I.S.C. "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
   4. AWS "Structural Welding Code."

1.03 SHOP DRAWINGS

A. Shop drawings shall be checked by the contractor and submitted to the Architect for review in conformance with "Special Provisions" and General Notes before fabrication is begun.

B. The shop drawings shall include the following:
   1. Complete details and schedules for the fabrication of each member.
   2. Complete details, schedules, procedures and diagrams showing sequence of erection.
   3. Each member shown on the shop drawings shall be marked in such manner that the member designations on the drawings coincide with the member designations on the member in the field.
   4. Complete anchor bolt setting plan for use in setting anchor bolts and leveling plates/nuts under Section 03300.

PART 2 - PRODUCTS

2.01 STEEL MATERIALS AND COATINGS

A. Unless otherwise shown or specified, rolled steel plates, shapes (except WF), bars, rods and miscellaneous items shall be structural quality carbon steel complying with ASTM A36 (minimum yield 36,000 PSI). Wide flange shapes only shall comply with ASTM A992 (minimum yield 50,000 PSI).

B. Square and rectangular hollow structure section (HSS) steel members shall comply with ASTM A500, Grade B (minimum yield 46,000 PSI).

C. Round hollow structure section (HSS) steel members shall comply with ASTM A500, Grade B (minimum yield 42,000 PSI).

D. High strength threaded fasteners shall be heavy hexagon structural bolts, heavy hexagon nuts and washers complying with ASTM F1852 (A325) – twist-off-type tension-control bolts.

E. Anchor bolts shall comply with ASTM F1554, GR. 36. Provide heavy hexagon structural nuts and washers as required.

F. Welded headed studs to be used as concrete anchors shall be low carbon steel solid fluxed studs complying with ASTM A-108 with a minimum Fu = 60 KSI. They shall be automatically end welded.

G. Electrodes for manual shield and metal-arc welding shall be covered mild steel electrodes complying with AWS Code.

H. Electrodes and flux for submerged arc welding shall be bare mild steel electrodes and fluxes complying with AWS Code.

I. Exterior exposed structural steel hot-dipped galvanized, including fasteners.

J. Washers for high strength bolts shall be flat circular hardened steel washers conforming to ASTM F436.

K. Remove all rolling marks and I.D. marks on exposed steel members.

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate items of structural steel in accordance with the requirements of A.I.S.C. Specifications and as indicated on the final shop drawings.

B. Properly mark and match-mark all materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize the field handling of materials.

3.02 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"(13th Edition). Standard double-angle bolted and/or welded connections shall be provided, unless otherwise indicated on drawings. Simple span connections for beams shall be designed for one-half the beam load capacity as given in AISC Table 3-6 "Maximum Total Uniform Load".

G. Length of connection angles for beam-to-column or beam-to-beam connections shall be the largest standard length less than or equal to the "T" dimension of the beam. Standard lengths and available strength of connection angles are found in "A.I.S.C. Manual of Steel Construction (13th Edition), Tables 10-1 thru 10-3.

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.

3.03 SHOP PAINTING AND CLEANING

A. Before shipping from the shop all steel shall be cleaned. Remove heavy rust and mill scale, spatter, slag or flux deposits. Comply with Steel Structures Painting Council SP-2 "Hand Tool Cleaning" or SP-3 "Power Tool Cleaning" or SP-7 "Brush-Off Blast Cleaning." Remove oil, grease and similar contaminates; comply with SSPC SP-1 "Solvent Cleaning."

B. All exterior exposed structural steel shall be hot dip galvanized.

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 ERECTION

A. The erection of structural steel and related work shall comply with A.I.S.C. Specifications, Code of Standard Practice and as specified herein.

B. Maintain work in a safe and stable condition during erection. Provide temporary shoring and bracing members as required, with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment and stability of the structure as erection proceeds.

C. The contractor under this Section shall furnish all anchor bolts, nuts, washers, leveling plates and other connections required for securing structural steel to other in-place work.

D. Anchor bolts furnished under this Section shall be placed under Section 03300. Before starting the work, this contractor shall inspect and approve work done under Section 03300. It shall be the responsibility of the contractor under Section 03300 to correct any work not acceptable to receive work to be done under this Section.

E. Touch-up any damaged galvanizing on exterior exposed structural steel with zinc chromate paint containing a minimum of 6% zinc chromate solids.

3.06 FIELD ASSEMBLY

A. Set structural columns and beams accurately to lines and elevations indicated. Align and adjust the various members forming a part of the complete frame or structure before

permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

B. Level and plumb individual members of the structure to an accuracy established under Section 7.11, Frame Tolerances, of the A.I.S.C. Code of Standard Practice adopted effective September 1, 1986.

C. Do not enlarge unfair holes in members by burning or by the use of drift pins. Holes that must be enlarged to admit bolts shall be reamed.

D. Splice members only where shown or indicated on approved shop drawings.

3.07 QUALITY CONTROL

A. The Contractor will engage an independent testing and inspection agency approved by the architect to inspect high-strength bolted connections, welded connections and shear studs and to perform tests and prepare test reports.

B. Testing agency shall conduct and interpret tests and state in each report whether test specimens comply with requirements, and specifically state any deviations therefrom.

C. Provide access for testing agency to places where structural steel work is being fabricated or produced so that required inspection and testing can be accomplished.

D. Testing agency may inspect structural steel at plant before shipment; however, Architect reserves right, at any time before final acceptance, to reject material not complying with specified requirements.

E. Correct deficiencies in structural steel which inspections and laboratory test reports have indicated to be not in compliance with requirements. Perform additional tests, at Contractor's expense, as may be necessary to reconfirm any non-compliance of original work, and as may be necessary to show compliance of corrected work.

3.08 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 prequalified.

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 judgement 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.

END OF SECTION 05120

SECTION 05210 - STEEL JOISTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.

B. This section includes furnishing all steel joist, joist girders, related materials, labor, tools, equipment and services necessary for the fabrication, delivery to the site, unloading, handling, storing and erecting of all steel joist shown on the drawings, and/or specified herein.

1.02 RELATED DOCUMENTS

A. Comply with the provisions of the latest editions of the following Codes, Specifications and Standards, except as otherwise shown or specified herein.
   1. A.I.S.C. and SJI "Standard Specifications and Load Tables for Open Web Steel Joists and Joist Girders."
   2. AWS "Structural Welding Code." D1.1
   3. Specification Section 05120

1.03 SUBMITTALS

A. Shop Drawings
   1. Prior to fabrication, shop drawings shall be checked by the contractor and submitted to the Architect for review.
   2. Shop drawings shall include joist layout, erection details, connection details, bridging details, mark, type and location.
   3. Each member shown on the shop drawings shall be marked in such manner that the member designations of the drawings coincide with member designations on the member in the field.
   4. All steel joists and joist girders shall be produced by an S.J.I. member or 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.
   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 of the steel joists and joist girders.

PART 2 - PRODUCTS

2.01 MATERIALS AND MANUFACTURE

A. Joist 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.

B. Joist shall be sprayed or dipped with one shop coat of gray paint standard with the manufacturer.

C. Joist 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.

D. 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 70 PSF shall not exceed 1/360 of the span length, unless noted otherwise on the design drawings.
2. Joist girders shall have approximate cambers as recommended by the standard specifications for joist girders.

E. Design of steel joists and joist girders shall be the sole responsibility of the contractor/joist manufacturer.

F. 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.

G. 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.

H. 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.

I. Provide misc. angle framing between joists as on the “Typical Roof Opening” details at all roof drains and misc. roof penetrations.

PART 3 - EXECUTION

3.01 BEARING AND ANCHORAGE

A. Minimum bearing for joist on structural steel shall be 2-1/2 inches.

B. Ends of joist bearing on steel supports shall be connected thereto with two 1/8-inch fillet welds 2 inches long unless otherwise shown or noted. Bolt joists as required per OSHA requirements. Refer to section 05120 for additional welding requirements.

C. Minimum bearing on masonry shall be 4 inches.

3.02 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 joist immediately after erection and before construction loads are applied.

C. The ends of bridging lines terminating at masonry walls shall be anchored by strap anchors attached to the wall.

3.03 HANDLING AND ERECTION

A. 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.

B. Place and secure steel joist as shown on plans in accordance with A.I.S.C. and SJI Specifications and as specified herein.

C. Install joists straight, plumb and properly aligned.

D. 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. Do not apply paint until field weld has inspected and approved.

END OF SECTION 05210

SECTION 05310 - METAL ROOF DECKING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work specified in this section.

B. This section includes all labor, materials, equipment and related services required to fabricate, deliver to the job site and erect all metal roof deck and accessories, as indicated or specified herein.

1.02 RELATED DOCUMENTS

A. Comply with the provisions of the latest editions of the following Codes, Specifications and Standards except as otherwise shown or specified.
1. A.I.S.C. "Specifications for the Design of Cold-formed Steel Structural Members."
2. A.W.S. "Structural Welding Code. D1.3"
3. S.D.I. "Steel Roof Deck Design Manual."

1.03 SUBMITTALS

A. Shop Drawings
1. Prior to fabrication, shop drawings shall be checked by the contractor and submitted to the Architect for review.
2. The shop drawings shall include layout of deck panels, anchorage details, supplementary framing, special jointing and accessories required for proper installation of the metal roof decking.

PART 2 - PRODUCTS

2.01 MATERIALS AND DESIGN

A. Materials
1. Basic steel shall be flat rolled sheets of structural quality, meeting the requirements of ASTM A653-94 Structural Quality Grade 33 or higher.
2. Shop Finish - Before fabrication, the basic steel shall be galvanized to comply with ASTM A924-94, with a minimum Coating Class of G90 as defined in ASTM A653-94.
3. Roof deck, except for apparatus bay, 1 ½ inch 20-gauge metal deck, Type B with a fabricated valley spacing of 6 inches with a minimum section modulus of 0.186 in.3. Sheets shall be continuous for at least 3 spans where possible.
4. Roof decking over apparatus bay shall be 20 gauge/20 gauge cellular acoustical metal deck, type BPA by Vulcraft or approved equal, with a fabricated depth of 1 1/2 inches and a valley spacing of 6 inches. The minimum section modulus shall be 0.234 in.3. Sheets shall be continuous for at least 3 spans where possible.

B. Design
1. Maximum fiber stress shall not exceed 20,000 PSI under a total dead and live load of 75 PSF. Deflection shall not exceed 1/360 of the span under a live load of 40 PSF, nor shall it exceed 1/240 of the span under a total dead and live load of 75 PSF.
2. 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 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 manner as to not damage the material and placed to provide as little re-handling as possible.

3.02 INSTALLATION

A. Installation shall be in strict accordance with the final shop drawings and requirements herein. Decking units shall be handled in a manner to avoid damaging the units. Decking units shall be placed only over supports which have been accurately aligned and secured in position. Joints and end laps shall be tight but made without stretching. End laps of 1 ½ inch deck shall be 2 inches or more and shall be made over supports. Ends of 2-inch deck shall be accurately aligned and adequately bearing on supporting members.

B. After decking is placed and adjusted to the final position, permanently fasten deck units to steel supporting members with screws, size and spaced as indicated on the drawings.

C. Side laps of adjacent units shall be fastened with screws as indicated on the drawings.

D. 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.

3.03 INSPECTION

A. Special Inspectors shall be retained by the Contractor to ensure that the deck is fastened properly, prior to placement of cover materials. Written approval of deck installation is required prior to proceeding with construction.

END OF SECTION 05310

SECTION 05500 - 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.
6. Interior Ladders (contractor's option to aluminum specified in section 07725).
7. Steel bar grating landing sytem.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 03300 - Cast-In-Place Concrete
Section 04210 - Face Brick Masonry
Section 05100 - Structural Steel
Section 05210 - Steel Joists
Section 05310 - Metal Roof Decking

1.03 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.

1.04 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.

1.05 SUBMITTALS

A. Furnish to the Architect for approval, complete shop and field erection drawings.

1.06 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 05500

SECTION 06100 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 06200 - Finish Carpentry
Section 06400 - Architectural Woodwork
Section 08211 - Flush Wood Doors
Section 08710 - Finish Hardware
Section 09250 - Gypsum Drywall - Steel Stud Construction
Section 09900 - Painting
Section 12325 - Plastic Laminate Cabinets and Casework

1.03 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.

1.04 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.

1.05 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 06100

SECTION 06190 - PREFABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Pre-engineered, prefabricated wood, roof trusses, truss girders, truss bracing and bridging, and all connections, including those between the trusses and common building framing, as indicated on the Drawings and specified herein.

B. Drawings indicate overall intent, and may include profiles and dimensions of trusses for communication of intent only.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 - Rough Carpentry.

1.03 QUALITY ASSURANCE

A. Conform to the following design standards:
   1. "National Design Specification for Wood Construction", published by the National Forest Products Association.
   2. "Design Specification for Metal Plate Connected Wood Trusses", published by the Truss Plate Institute (TPI).
   3. "American Institute for Timber Construction" (AITC).
   4. All applicable state and local building codes.

B. Provide trusses fabricated in accordance with designs prepared under the supervision and bearing the seal of a Professional Structural Engineer, registered in the state of project location.

C. Conform to the following Fabrication and Erection Standards:
   1. "Bracing Wood Trusses", published by the TPI.
   2. "Quality Control Manual", published by TPI.

D. Design trusses to the following loads and requirements, unless indicated otherwise on the Drawings:
   1. Live Load Deflection Criteria = L/240 maximum.
   2. Total Load Deflection Criteria = L/180 maximum.
   3. Roof: Top Chord Live Load = 20 psf.
   4. Roof: Top Chord Dead Load = 20 psf.
   5. Roof: Bottom Chord Dead Load = 10 psf.
   6. Wind = 90 mph.
   7. Exposure = C.
   8. Design all truss connector plates using an extra safety factor of 1.20 in addition to the standard design requirements listed above.
   9. Camber Trusses to equal the dead load deflection.

1.04 SUBMITTALS

A. Shop Drawings:
   1. Details and elevations on the Drawings are diagrammatic and are intended to span the basic intent of the truss requirements for design by the truss manufacturer.
   2. Submit shop drawings for review of intent, profiles and overall dimensions to verify conformance with the design intent, and not for structural capability of design.
   3. Indicate length, depth, bearing points, pitch, span, profile, quantity, components, grades, configuration, required openings and critical dimensions.
   4. Prepare drawings for field erection. Mark and locate all trusses on Drawings. Indicate all bracing

and anchoring.

B. Engineer's Certification:
1. Shop drawings and design load calculations shall be prepared, stamped and certified by a Structural Engineer registered to practice in the State of the project location.
2. Structural Engineer shall be hired by the truss manufacturer and shall oversee design of the structural requirements, truss components and connection members.
3. Design truss and wood framing connections in accordance with all requirements of the "Truss Plate Institute", the "National Forest Products Association" and the "American Institute for Timber Construction".
4. Design calculations shall indicate vertical displacement due to loading conditions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle prefabricated trusses to avoid damage, and in accordance with manufacturer's instructions.

B. Protect trusses from construction operations.

C. Replace damaged trusses. Do not attempt to repair damaged prefabricated trusses.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Lumber:
1. Species, and grade as required for design load.
2. All lumber for chords and webs to be No. 2 or Better. No. 3 lumber is NOT permitted.
3. Nominal thickness: 2 inches.
4. Nominal width: as required for design load.

B. Metal Connector Plates:
1. Minimum thickness: 0.036 inches.
2. ASTM A446, Grade A.
3. Hot Dip Galvanized per ASTM A525, G60.

C. Connections between wood trusses and common lumber framing shall be made with the appropriate "Simpson" Strong-Tie anchor and connector.

PART 3 - EXECUTION

3.01 PREPARATION

A. Field verify all dimensions and conditions prior to fabrication.

B. Wood trusses shall NOT be assumed structurally stable until all members are in place. Any use of the partially erected framework for temporary support of any kind shall be done only at the sole risk of the Contractor.

3.02 FABRICATION

A. Fabricate trusses with wood chords and metal or wood webs in accordance with designs certified by the Structural Engineer.

B. Fabricate and install metal connector plates in accordance with latest edition of "Truss Plate Institute"

Standards and Procedures.

C. Fabricate and install truss and wood framing connections in accordance with all requirements of the "Truss Plate Institute", the "National Forest Products Association" and the "American Institute for Timber Construction".

D. Multiple trusses, double or triple trusses, shall be utilized, as required, to maintain deflection limits.

3.03 ERECTION

A. Install trusses in accordance with manufacturer's instructions, recommendations and design.

B. Hoist trusses into position so as to prevent damage and minimize out-of-plane bending.

C. Install temporary horizontal and cross bracing to hold trusses plumb and in safe.

D. Install permanent bracing and related components prior to application of loads to trusses.

E. Restrict construction loads to prevent over stressing of truss members.

F. Do not cut or remove truss members or metal connector plates.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Engineer’s Certification.

END OF SECTION 06190

SECTION 06200 - 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.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 - Rough Carpentry
Section 06400 - Architectural Woodwork
Section 08710 - Finish Hardware
Section 09900 - Painting

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. 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.

1.04 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.

1.05 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.

1.06 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. Particle Board:
1. Medium Density, Type 1-M-2.
2. Thickness as indicated on the Drawings. If not indicated, provide 3/4” standard.

B. 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%.

C. 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).

D. Fire Treated Wood:
1. ASTM - E84
2. Flame Spread - 25 max.
3. Kiln-dried after treatment to 15% max. moisture content.

E. 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.

F. Solid Surface Window Sills:
1. Acceptable Manufacturers and Products:
a. "Dupont", "Corian".
b. "Wilsonart", "Gibraltar".
c. "Formica", "Formica Solid Surfacing".
d. "Meganite", “Meganite”.
e. "Avonite Surfaces", "Avonite".
f. “LG Hausys”, “Acrylic Solid Surface”.
g. “Hanwha L&C”, “Hanex Solid Surface”.
2. 1” total sill thickness provided from one of the following, depending on color availability:
a. 1" thick solid surface material.
b. 1/2" thick solid surface material laminated atop 1/2" plywood or hardboard with edge bandings of 1" 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.

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.

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 06200

SECTION 06400 - ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Architectural Woodwork as shown on the Drawings and specified herein, including:
   1. Built-In Plastic Laminate Bench.
   2. Miscellaneous Ornamental Items.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 - Rough Carpentry.
Section 06200 - Finish Carpentry.
Section 08211 - Flush Wood Doors.
Section 08710 - Finish Hardware.
Section 09900 - Painting.
Division 15: Plumbing and Mechanical components, connections, taps, disposals, coordination.
Division 16: Electrical components, connections, and coordination.

1.03 QUALIFICATIONS

A. Supplier's Qualifications:
   1. Shop of manufacturer should be certified by the Architectural Woodwork Standards (AWS), and be capable of providing proof of such certification upon request.

1.04 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 of the quality grade indicated, or if not indicated, of Custom grade.

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.

1.05 SUBMITTALS

A. Samples:
   1. Complete range of manufacturer's standard finishes where colors or finishes are not specified.
   2. Samples of specified items only, where colors or finishes have been indicated.
   3. Samples of each type, material, color, pattern and finish of all countertops and surfaces specified.

B. Shop Drawings:
   1. Field measurements shall be taken to verify that architectural woodwork, 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 architectural woodwork, cabinets and casework 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.

4. Shop drawings on all architectural woodwork items, of sufficient detail and scale to determine compliance with design intent and specified quality grades.
5. Manufacturer's descriptive literature of specialty items not manufactured by the architectural wood worker.

1.06 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.

C. Deliver architectural woodwork, cabinets and casework as needed for immediate installation whenever possible. Any items delivered ahead of time for installation shall be stored by Contractor until project areas are ready for installation.

1.07 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.

1.08 WARRANTY

A. Architectural woodwork, cabinets and 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.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Interior Wood for Painted Finish:
   1. Poplar, AWS, Custom Grade.

B. Hardwood Plywood:
   1. Product Standard PS 51.

C. Softwood Plywood:
   1. Product Standard PS 1.

D. Treated Paper Surfaced Plywood:
   1. Resin-Fiber overlaid plywood, un-grooved panel.

E. Plastic Laminate:
   1. Acceptable Manufacturers:
      a. "Formica"
      b. "Wilsonart"
      c. "Nevamar"
      d. "Pionite"
   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 HGS-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: High-pressure decorative laminate VGS-28 (0.028”).
   f. Semi-Exposed Cabinet Body Interior: 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.

F. Particle Board:
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.

G. Accessories:
1. Fillers, tops, end and side closures; finish to match adjacent cases, cabinets and countertops.
2. Finished back and end panels as required or indicated.
3. Back splashes on all countertops. End splashes only as specified.

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. 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.

J. 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 FABRICATION

A. Custom Casework:
1. Fabricate in compliance with AWS Premium Grade for all cases and cabinets.
2. Fabricate in compliance with AWS Premium Grade for plastic laminated tops.
3. Fabricate in shop in largest units possible.
4. Machine for all hardware in shop.

B. Miscellaneous Ornamental Work:
   1. Fabricate in compliance with AWS Section 700, Premium Grade.

C. Joinery:
   1. Handwrap fluted dowel construction.
   2. 8mm minimum.
   3. Doweled and glued.

PART 3 - EXECUTION

3.01 PREPARATION

A. Field measure all areas to receive architectural woodwork prior to fabrication. Provide any necessary closures and trim to fit the items to enclosing walls. Provide other trades with information necessary for proper completion of related work.

B. Not all details of millwork are shown on the Drawings. Utilize the most advantageous manufacturing processed to achieve the quality and design intent indicated.

C. Install architectural woodwork only after flooring and wet work have been finished and proper heat and ventilation have been provided to maintain a uniform heat with not more than 50 percent relative humidity. Allow 7 days of storage of architectural woodwork in area in which it is to be installed to permit wood to reach optimum moisture content.

D. All laminated doors and drawers to be laminated all sides with GP-50, 0.50" thick.

3.02 INSTALLATION

A. Exercise care to avoid damage to finished surfaces during handling and erection. Repair all damaged surfaces and blemishes arising from such operation. Replace items which cannot be satisfactorily repaired.

B. Install paneling in correct position with concealed mechanical fastenings. Provide a minimum of nine (9) mechanical fasteners per wall panel unit, installed in such a way as to draw the panel uniformly tight to the supporting framework.

C. Install all scribe strips accurately fitted to adjacent surfaces and securely anchored in position.

D. Field modify architectural woodwork to accommodate conduits, piping, etc., in a neat and workmanlike manner.

E. Attach all casework to floors and walls and anchor by concealed bolts or wood screws into inserts on floors and grounds, blocking, and nailers on walls. Provide all grounds, blocking, and nailers as necessary for all items.

F. Install casework so that doors will fit openings properly and be accurately aligned. Adjust hardware to center doors and provide unencumbered operation.

3.03 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork properly to eliminate defects functionally and visually; where not possible to repair properly, replace woodwork. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate and make final adjustments for proper operation.

C. Clean all woodwork and cabinets on exposed and semi-exposed surfaces, inside and out. Touch-up shop-applied finishes to restore damaged or soiled areas. Clean all plastic laminate with mild abrasive cleaner and polish with “Cabinet Magic” or similar laminate polish product.

D. Complete the finishing work specified as work of this section, to whatever extent not completed at shop or prior to installation of woodwork.

3.04 PROTECTION

A. Protect architectural woodwork so that it is without damage or deterioration at time of substantial completion.

SUBMITTAL CHECK LIST

1. Samples.
2. Shop Drawings.
3. Manufacturer’s Literature.

END OF SECTION 06400

SECTION 07190 - WATER REPELLENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work covered by this Section includes water repellent protective coating applied to concrete and masonry surfaces, as indicated on the Drawings and specified herein.

B. To be applied over all Brick and Stone (limestone) materials throughout the project, whether indicated or not.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data sheets, cutsheets, specifications and materials description.
   2. Manufacturer's test data, stating coating performance expectations and limitations.
   3. Manufacturer's Material Data Safety Sheets (MSDS).
   4. Manufacturer's installation instructions, stating specific conditions requiring special attention and cautionary procedures required during application.
   5. VOC content.

B. Certifications:
   1. Manufacturer's certification that products meet or exceed the specified requirements.
   2. Manufacturer's documentation of experience indicating compliance with specified qualification requirements.
   3. Applicator's documentation of experience indicating compliance with specified qualification requirements.

C. Warranty:
   1. Manufacturer's written warranty as specified.
   2. Applicator's written warranty as specified.

1.03 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened, containers.

B. Transport, handle, store and protect products in strict accordance with the manufacturer's requirements and recommendations.

C. Protect coating liquid from freezing. Discard and replace any product exposed to freezing conditions.

1.04 QUALITY ASSURANCE

A. Manufacturer and Supplier's Qualifications:
   1. Manufacturer shall be a professional company specializing in manufacturing the specified products, with a minimum of five (5) years of documented experience.
   2. Applicator shall be a professional company specializing in performing the work of this Section, with a minimum of five (5) years of documented experience.
   3. Manufacturers and Suppliers wishing to be have products included for bidding shall submit qualifications in writing to the Architect no later than ten (10) days prior to the bid.

B. Regulatory Requirements:
   1. Comply with applicable rules and regulations of Pollution Control regulatory Agency having jurisdiction regarding volatile organic compounds (VOC) and use of hydrocarbon solvents.

1.05 WARRANTY

A. Manufacturer's written warranty agreeing to supply any/all materials as required for repair or reapplication of materials that fail to provide water repellency, as determined by the Architect.

B. Applicator's written warranty agreeing to perform any/all work as required for repair or reapplication of materials that fail to provide water repellency, as determined by the Architect.

C. Warranty period for both the manufacturer and applicator shall be three (3) years from the date of Substantial Completion.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following manufacturers:
1. "ProSoCo, Inc."
2. "Tnemec, Inc. / Chemprobe"prosoco
3. “Foxfire International”
4. "Tremco Barrier Solutions"

2.02 MATERIALS

A. Provide one of the following approved systems:
1. Brick, Concrete Block:
a. "ProSoCo, Inc.", Sure Klean, Weather Seal, Siloxane WB.
b. "ProSoCo, Inc.", Sure Klean, Weather Seal, Siloxane PD.
c. "Tnemec, Inc.", Chemprobe, Series V662, Prime-a-Pell Plus.
d. "Foxfire International", Foxfire 5000WB.
e. “Tremco”, Chemstop WB Heavy Duty.
2. Poured-In-Place Concrete:
a. "ProSoCo, Inc.", Sure Klean, Weather Seal, Siloxane WB.
b. "ProSoCo, Inc.", Sure Klean, Weather Seal, Siloxane PD.
c. "Tnemec, Inc.", Chemprobe, Series V662, Prime-a-Pell Plus.
d. "Foxfire International", Foxfire 5000WB.
e. “Tremco”, Chemstop WB Regular.
3. Limestone:
a. "ProSoCo, Inc.", Sure Klean, Weather Seal, Natural Stone Treatment WB.
b. "Tnemec, Inc.", Chemprobe, Series 663, Prime-a-Pell N.S.

B. Description:
1. Siloxane/Silane, water-based, penetrating water repellent.
2. Formulated for use on above-grade concrete and masonry, vertical and horizontal surfaces.
3. Formulated to help concrete and masonry surfaces to resist cracking, spalling, staining and other damage related to water intrusion.
4. Resistant to ultraviolet and weather deterioration.
5. Ready-to-use without requirement for on-site mixing or dilution.
6. Alkaline stable, low odor.
7. Clear, filmless and invisible when dry. Shall not alter the color or texture of the substrate surface.
8. Non-staining, non-yellowing, and breathable.
9. Reduce efflorescence and spalling.

C. Performance Data:
1. VOC content to be 400 grams/liter (3.34 lbs/gallon), maximum.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Contractor shall be responsible for inspection of site, approval of substrate surfaces, installation conditions and field measurements for this work.

B. Verify that all conditions are as required and ready to receive work.

C. Verify that all joint sealants are installed and cured.

D. Verify that all surfaces to be coated are dry, clean, and free from efflorescence, oil, or other matter detrimental to application of coating.

E. Report in writing any prevailing conditions that will adversely affect the satisfactory execution of the work. Do not proceed with work until any/all unsatisfactory conditions have been corrected.

F. Commencement of work constitutes acceptance of all conditions by the Contractor and assumes the responsibility for correction of unsuitable conditions encountered at no additional costs to the Owner.

3.02 ENVIRONMENTAL CONDITIONS

A. Do not apply products during the following conditions:
   1. Ambient temperature below 40 degrees F.
   2. Rain or temperatures below 40 degrees F are predicted for a period of 24 hours after application.
   3. Substrate surfaces frozen or surface temperatures are below 40 degrees F.
   4. Substrate surfaces have cured less than 30 days.
   5. Substrate surfaces not dry for a minimum of 24 hours prior to application.

3.03 PREPARATION

A. Remove loose particles and foreign matter. Remove oil or foreign substance with a cleaning agent that will not affect coating.

B. Scrub and rinse all surfaces with water and allow to thoroughly dry.

C. Protect adjacent surfaces not scheduled to receive coating. If applied on unscheduled surfaces, remove immediately by methods approved by the manufacturer.

D. Protect landscaping, property and vehicles from overspray and drift.

3.04 APPLICATION

A. Delay work until masonry mortar is cured fro seven (7) days, minimum.

B. Apply coating in strict accordance with manufacturer's published instructions, using appropriate methods and coverage rates per coat.

C. Apply two (2) coats, minimum.

SUBMITTAL CHECK LIST

1. Product Data.
2. Certifications.
3. Warranty.

END OF SECTION 07190

SECTION 07200 - 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 RELATED SECTIONS

Section 03300 - Cast-In-Place Concrete
Section 04210 - Face Brick Masonry
Section 04220 - Concrete Unit Masonry
Section 04430 - Limestone
Section 07263 – Medium Density Closed Cell Polyurethane Foam Air Barrier
Section 07410 - Metal Wall Panel
Section 09250 - Gypsum Drywall - Steel Stud Construction

1.03 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.

1.04 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and installation instructions for each type of insulation required.
2. Material Safety and Data Sheets (MSDS).

1.05 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.

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. Foundation Wall 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.

SUBMITTAL CHECK LIST

1. Product Data.

END OF SECTION 07200

SECTION 07263 – 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. Door frames.
      f. Piping, conduit, duct and similar penetrations
      g. Masonry ties, screws, bolts and similar penetrations.
      h. All other air leakage pathways in the building envelope.
   4. Materials to act as flashings and counterflashings.

1.02 RELATED SECTIONS

Section 04220 – Concrete Unit Masonry
Section 06100 – Rough Carpentry

1.03 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.

1.04 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.

1.05 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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.

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.

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 and/or performance of required air spaces.

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 07263

SECTION 07410 - METAL WALL AND SOFFIT PANELS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Metal wall and soffit panels 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-1 Aluminum or equal.
   2. Panels:
      a. Aluminum.
      b. 12” width coverage.
      c. Concealed fastened panel.
   3. Profile:
      a. 1” to 1-1/2” nominal panel height.
      b. Flush face solid surface.
   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 24” o.c., minimum.
      d. Adjacent panel installed in tongue-and-groove type fashion to cover and conceal fastener.

B. Gauges:
   1. 22 gauge minimum for panels up to 20’ lengths.
   2. 20 gauge minimum for panels exceeding 20’ lengths.

C. Finish:
   1. Exposed side: Kynar 500 (PVDF) with required warranties.
   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.

D. Flashing and Trim:
   1. Material:
      a. Aluminum.
      b. Minimum 22 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.

E. 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 panel system is to be installed.
Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install wall and soffit panel system 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 07410

SECTION 07420 – CURVED COMPOSITE METAL PANELS (ACM)

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision required to install aluminum composite metal (ACM) panels as indicated on the Drawings and specified herein.

B. All necessary associated trim, gaskets, sealants, fasteners, etc., required to create and maintain a weathertight enclosure system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 07900 - Joint Sealers

1.03 QUALITY ASSURANCE

A. Curved composite panel system shall have been tested and certified for compliance with requirements as specified herein and designed in accordance with accepted practices of a Curtain Wall Manufacturer's Association utilizing the rain screen principle.

B. Curved Panel System shall have proven field performance of a minimum of 5 years.

1.04 TESTING & PERFORMANCE REQUIREMENTS

A. Thermal Movement:
Designed for expansion and contraction resulting from ambient temperature range of 120° F.

B. Wind Loading:
Tested in accordance with ASTM E330 to withstand a minimum uniform pressure of 30 psf inward and 30 psf outward.

C. Weather Resistance:
Demonstrate permanent resistance to leakages as follows with test pressure differential of 10% design wind pressure.
1. Air infiltration: no more than 0.01 cfm per square foot, tested in accordance with ASTM E283 @ 6.24 lbs. per square foot.
2. Water infiltration: No uncontrolled water penetration, tested in accordance with ASTM E331 @ 15 lbs. per square foot.
3. Dynamic Water Infiltration: No uncontrolled water penetration, tested in accordance with ASTM E331 @ 15 lbs. per square foot.

D. Fire Resistance:
Meet the following minimum fire performance test criteria:
1. ASTM E84-Steiner Tunnel. Flame Spread: 0. Smoke Development:10.
2. ASTM D1929 Ignition Temperature – minimum 752 degrees F.
3. ASTM E108 Modified – Passed.
4. ASTM D635 – Classified CC1.

E. Bond Integrity:
1. Bond Strength, 214 psi (vertical pull per ASTM C297).
2. Peel Strength, 25.9 in-lb per inch.

F. Tolerances:
Maximum deviation from theoretical plane shall not exceed 1/4" in any 20'-0" length or height of panel.

1.05 SUBMITTALS

A. Product Data:
Manufacturer's specifications, standard details, and installation recommendations for components required for project, including data that products have been tested and comply with performance requirements.

B. Shop Drawings:
Shop Drawings for fabrication and installation including elevations, detail sections of typical panels, anchorages, reinforcements, expansion provisions and caulking requirements.

C. Samples:
Samples of each type and color of aluminum finish, on 6" square sheets.

1.06 WARRANTY

A. Material and Workmanship:
Composite panel manufacturer shall warrant that the material referenced herein will be free from defects in material and in related workmanship for period of 2 years.

B. Finish:
Composite panel manufacturer shall warrant a color change of no greater than 5 Delta E units in accordance with ASTM D2244, a maximum chalk rating of 8 in accordance with ASTM D659, no checking, no crazing, no oil-canning, or no loss of adhesion for a period of ten (10) years.

PART 2 - PRODUCTS

2.01 SYSTEMS

A. Provide one of the following systems, as approved by the Architect:
1. “Royalton Architectural Fabrication, Inc.”; Royaltech 3000 Series.
2. “Laminators, Inc.”; Omega-Lite Dry Seal System.
3. “Engineered Architectural Systems, Inc.” (EAS); ACM Composite Cladding.
4. “Shaffner Heaney Associates, Inc.”; SHApe Architectural Products RLS-9000.
5. “Sobotec, Ltd.”; SL-3000.
6. “Miller-Clapperton”; System 500.

B. See Specifications Section 01630 - Product Options and Substitutions.

2.02 MATERIALS

A. Aluminum Composite Materials:
1. 5/32" (4mm) thick with .020" minimum aluminum face both sides.
2. Aluminum faces shall be bonded in tension to an extruded thermoplastic core formed in a continuous process with no glues or adhesives between dissimilar materials.
3. Acceptable Manufacturers:
a. “Mitsubishi Plastics”, "Alpolic".
b. “3A Composites”, "Alucobond".
c. “Alcoa”, "Reynobond".

B. Finish:
1. Minimum 70% fluorocarbon resin coating conforming to AAMA 605.2.
2. Minimum Two Coat Manufacturer's Color.
3. Gloss 30%.
4. Color as indicated, or if not indicated as selected from manufacturer’s entire range of selections.

C. System Thickness: Nominal 2”.

D. Panel Joinery (Dry Joint Rain Screen Pressure Equalized System):
1. Interlocking male/female horizontal and vertical panel joints shall be created by factory attachment of continuous perimeter extrusions to the composite material.
2. Perimeter joint extrusions shall be designed to provide concealed fastening.
3. Perimeter joint extrusions shall also accommodate panel expansion and contraction and provide continuous reinforcement at the panel returns.
4. All joints shall be designed as dry joints.
5. Provide joint filler strip made of matching ACM at panel joints.
6. Rivet heads within joint shall be painted with matching color to blend with filler strip.

E. Panel Stiffeners:
1. Extruded aluminum stiffeners shall be shop attached to the perimeter extrusions and adhered to the back side of the composite material with structural silicone.
2. Stiffeners shall be used wherever panels exceed 4’ x 6’ or more frequently as deemed necessary by the panel fabricator.

F. Joint Seals:
1. The use of exposed sealant will not be permitted.

G. The completed panel system shall comply with the performance requirements specified herein.

H. Comply with dimensions, panels sizes, thickness and fabrication details shown on the bid documents.

I. Apply protective strippable film to finished surfaces for protection during fabrication, shipment, and installation.

J. Reveal Joints:
1. Composite lap strip insert for dry application.
2. Insert color to be as indicated, or if not indicated, as selected by Architect from manufacturer's entire section.

K. Attachment Clips:
1. Design attachment to structural support so as to provide for movement in all directions.
2. Provide all necessary shims, clips, etc. to assure alignment specified.

L. Furring Strips:
1. Provide galvanized steel Z-furring strips at all panel joints and as otherwise required to install panel system.

2.03 FABRICATION

A. Comply with dimensions, profile limitations, thicknesses and fabrication details shown on contract drawings.

B. Fabricate components of the system at factory, ready for field installation. No field cutting of panels will be permitted.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine alignment of substrate framing prior to installation.
Installation of panels shall signify contractor's acceptance of substrate conditions.

B. Inspect material included in this contract prior to installation.

3.02 INSTALLATION AND ERECTION

A. Install air and moisture barrier and seal perimeter, laps, and penetrations per manufacturer's instructions.

B. Install the composite panels, fasteners, trim and related items in accordance with approved shop/erection drawings and fabricators basic specifications. Panels shall be installed by the fabricators and/or approved erectors who have been trained and have experience in the installation of the particular type of panel system specified.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.
3. Samples.

END OF SECTION 07420

SECTION 07536 - 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. Two types of systems are specified: Adhered System and Adhered Feltback System.
   1. Provide system installation as indicated on the Drawings for each area in the project. If not indicated, provide systems as identified below.
   2. The Adhered System is used at low slope roofs, generally out of view.
   3. The Adhered Feltback System is used at shed and gable roofs.
   4. The Adhered Feltback System is used wherever the decorative thermoplastic rib battens are indicated to be installed.

C. 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.

   2. Adhered Feltback 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, with felt backing, 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, ice guards and all additional items necessary to complete the work and meet the manufacturer's warranty requirements for a complete system warranty.
      f. Application of decorative thermoplastic rib battens, where indicated.

D. The words "ply", "membrane", and "sheet" are used interchangeably, and are to be interpreted as having the same meaning.

E. 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.

F. 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.

G. Work also includes installation of acoustical flute fillers at acoustical roof decks. Acoustical filler is provided by deck supplier, and is specified in Section 05310.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 01732 – Cutting and Patching (including, but not limited to, cutting and patching of existing foam roof system for installation of new mechanical equipment.)
Section 05310 – Metal Roof Deck
Section 06100 – Rough Carpentry
Section 07600 – Flashing, Sheet Metal and Accessories (gutters and downspouts, metal soffit panel)
Section 07651 – Flexible Flashing.
Division 15 – Mechanical and Plumbing work.

1.03 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.

1.04 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
   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.

1.05 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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.

1.10 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 accomodate phasing of the work, partial installations, and as otherwise requested by the Architect to address quality control issues.

1.11 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.

1.12 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 0.045".
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.

2. Adhered Feltback System:
   a. Provide one of the following acceptable products:
      1) "Sarnafil", G410-15 with factory applied felt back.
   b. Description:
      1) Certified minimum membrane thickness: as required for specified warranty, but not less than 0.060" plus 9 oz. geotextile felt backing.
      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 07600 - 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 and under satellite dish legs and around all rooftop equipment. 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.

J. Decorative Thermoplastic Rib Battens: (Provide at adhered feltback system where indicated on roof plan)
1. "Sarnafil", Décor Profile Rib.
2. Sarnafil PVC extrusion profile 3/4" x 1-1/4", used to emulate the appearance of a standing seam metal roof system.
3. Provide all items necessary for a complete and finished Décor Rib installation.
4. Provide at shed and gable roofs where indicated on the Drawings.
5. Provide at 24" o.c., unless otherwise indicated.

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" and 3" thick boards with a total thickness of 5" (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. Install Décor rib in accordance with manufacturer's instructions. Use Sarnamatic 641 machine welder with Décor adapter kit. Hot air weld Décor ribs in place. Ribs to be installed perfectly straight and in continuous lengths. Ends of ribs are to be trimmed neat and smooth. Spacing of ribs to be as indicated on Drawings, or if not indicated at 24 inches on center,

G. 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.

H. Install fiberglass acoustical material at flutes of acoustical decking.

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 07536

SECTION 07600 - FLASHING, SHEET METAL AND ROOF ACCESSORIES

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.
2. Metal wall flashing.
3. Exposed metal trim/fascia units.
4. Miscellaneous sheet metal accessories.
5. Metal gutters.
6. Metal Scuppers.
7. Metal downspouts.
8. Sheet metal flashing at windows and exterior doors.
9. Pre-manufactured metal coping. (See Section 07536 Thermoplastic Sheet Roofing System).

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.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Galvanized Steel:
1. ASTM A 525, coating G90.
2. Thickness (minimum):
a. 18 gauge.
b. 24 gauge flashing.
c. 22 gauge gutters.
d. 22 gauge, downspouts.
e. 20 gauge, scuppers

B. 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.

C. Fasteners:
1. Galvanized steel, hot dipped, flat head.
2. Aluminum for gutters and downspouts.

D. Cleats:
1. 2 inches wide, 3 inches long piece of sheet metal.
2. 16 oz., unless otherwise specified.

E. Bituminous Paint:
1. Asphalt emulsion, ASTM D 1187, Type A.

F. Sealant:
1. One-part butyl rubber sealant, FS TT-S-00657, Type 1.

G. 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.

H. 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. 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.

D. All exposed edges not seamed shall be hemmed, bent back 1/2 inch to unexposed side.

E. 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.

2.03 PRE-MANUFACTURED METAL COPING (See Section 07536 Thermoplastic Sheet Roofing System)

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. 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.

J. 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.

K. 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.

L. Gutters:
1. 6", Ogee (K-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.

M. Downspouts:
1. 3" x 4", plain square 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.

N. Gravel Stop:
1. Form 3/4 inch minimum height gravel stop.
2. Lap seam joints maximum 10 feet apart.
3. Fill roof flange joints with bituminous plastic cement.
4. Lock drip edge over continuous cleats secured to substrate.
5. Extend roof flange 4 inches onto roofing, set in plastic cement and secured to substrate with nails approximately 8 inches o.c.
6. Miter and bend corners, extend minimum 12 inches.
7. Coordinate with Thermoplastic Sheet Roofing System.

O. Scuppers:
1. Locate straps at downspout tops, bottoms and at 10 feet maximum centers.
2. Secure straps to wall with fasteners heads covered with strap tabs.
3. Fit strainers tightly in each downspout.
4. Extend minimum 3 inches into storm drain hub.
5. Grout with Portland cement to close opening and trowel top surface to slope away from downspout.

P. Coping: (See Section 07536 Thermoplastic Sheet Roofing System)

3.03 CLEANING AND PROTECTION

A. Remove, scraps and dirt as work progresses.

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 07600

SECTION 07615 - METAL ROOFING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to complete the standing seam metal roofing work indicated, noted and detailed on the Drawings and specified herein.

B. The roofing assembly generally includes, and not by way of limitation, preformed sheet metal panels, related accessories, valleys, hips, ridges eaves, corners, rakes, trims, underlayment, drainage and ventilation mat and miscellaneous flashing and attaching devices, for a complete watertight installation.

C. Includes snow guard system attached to roof panel battens.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 - Rough Carpentry
Section 07200 - Insulation
Section 07600 - Flashing, Sheet Metal and Roof Accessories
Section 07900 - Joint Sealers

1.03 QUALITY ASSURANCE

A. American Iron and Steel Institute (AISI) - Light Gauge Cold-Formed Steel Design Manual.

B. American Society of Testing Materials (ASTM):
1. A-116 Structural, Physical Quality of Galvanized Steel Sheet.
2. A-525 General Requirements for Galvanized Steel Sheet.
3. D-1056 Flexible Cellular Material.
4. B-209 Smooth or Stucco Embossed Prefinished Aluminum.
5. E-330-84 Test Method for Structural Performance by Uniform Static Air Pressure Difference.

C. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.

1.04 SUBMITTALS

A. Manufacturer's Literature:
1. Published materials description and specifications for each type roof specified.
2. Manufacturer's installation instructions for each type roof specified.

B. Samples:
1. 12” x 12” section of metal panel.
2. Full size sample of clip and batten.
3. Full size sample of snow guard system attached to a standing seam batten, with pipe attached.
4. 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 roof plan, layout of panels, anchoring details, joint details, trim, flashing, gutters 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.

1.05 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.

1.06 WARRANTY

A. Provide roofing/fascia manufacturers, one-year guarantee against defects in materials and workmanship, as delivered.

B. Provide roofing/fascia 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 roof 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.

E. Wind Rating:
1. UL 580 positive and negative pressure wind, passing a Class 90 rating.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide one of the following approved products:
1. "Metal Sales Manufacturing Corporation", Vertical-Seam.
2. "Petersen Aluminum", Snap-Clad.
3. "MBCI", Lok-Seam.
4. "Firestone Metal Products", Una-Clad UC4WTS.
5. "Drexel Metals Corporation", DMC 175S.
6. "DMI", Interlock.

2.02 METAL ROOF PANEL SYSTEM

A. Non-Structural Standing Seam Metal Roof Panel:
1. Material:
a. Roll formed, 24 gauge, G-90 hot-dipped galvanized steel.
b. Lengths to be continuous for full lengths, eave or gutter to ridge.

c. SHALL NOT OIL CAN. Oil canning WILL BE a cause for rejection, regardless of manufacturer's product literature or statements otherwise. Manufacturer shall submit heavier gauges, narrower widths or stiffening ribs as applicable for requirements of project to eliminate oil canning.

2. Width:
   a. 12 inch to 18 inch panel coverage, nominal to manufacturer's standard products, unless otherwise indicated.
3. Ribs:
   a. 1-1/2 inch minimum dimension, 2 inch maximum dimension.
   b. Ribs to have continuous anchor reveals to allow anchor clips to resist positive and negative loading and allow expansion and contraction of panels due to thermal changes.
   c. Factory-applied sealant to be installed at seam, which will not come in contact with the anchor clip and will not limit thermal movement of panel.
4. Seam:
   a. Continuous interlock with overlapping panel seam design.
   b. Seams are snapped together as an integral interlocking system without the need for a mechanical seaming tool.
5. Profile:
   a. To be selected by Architect from manufacturer’s entire selection of available profiles.
6. Anchor Clips:
   a. Entirely concealed with concealed fasteners, where provided.
   b. 16 gauge, G-90 hot-dipped galvanized steel.
   c. Allow for thermal expansion and contraction between panels.
7. Fasteners:
   a. Entirely concealed.
   b. Stainless steel sheet metal screws.
8. Finish:
   a. Top side: Kynar 500 Fluorocarbon coating applied on a continuous coil coating line. Dry film thickness of 0.70 to 0.90 mil over 0.25 to 0.35 prime coat. Total thickness to be 0.95 to 1.25.
   b. Bottom side: Acrylic wash coat, 0.3 -0.4 mil dry film thickness.
   c. Color 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.

B. Flashing and Trim:
1. Material:
   a. C-90 galvanized steel.
   b. Minimum 24 gauge.
2. Finish:
   a. Kynar 500 coating with 20-year warranty.
   b. Color to match roof 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 roof manufacturer.
5. Length:
   a. Continuous 10’-0” lengths with 6” splice plate to allow thermal movements.

C. Gutters:
1. As specified in Section 07600 - Flashing, Sheet Metal and Roof Accessories.
2. Color to match roof panel.

D. Foam Closure:
1. Black closed cell foam meeting ASTM D1056. Closures to be supported and protected from weathering by a metal channel matching the roof 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 edges and ridge conditions.

2.03 STRUCTURAL PERFORMANCE

A. Uniform load capacity shall be determined by testing in accordance with the principals of ASTM E 330 Adapted to testing of formed sheet panels by additions to specific sections as follows:
1. Roof test specimens shall be representative of the main body of the roof, free from influence of perimeter conditions. The setup shall be continuous over one or more supports and contain at least five panel widths for standing seam roofing.
2. No roof attachments are permitted at the sides other than the standard gable or rake condition. For uplift tests, at least one end seal shall be flexible and in no way restrain the crosswise distortion of panels. One end may simulate an eve condition if at least 12 feet away from the mid-roof clip under elevation.
3. Roofing panels and accessories are to be production material of the same type and thickness proposed for use on the project.
4. Longitudinal seals or plastic film shall not span any crevice or cracks that may tend to separate under pressure.

2.04 UNDERLAYMENT

A. Provide one of the following approved products:
1. "Grace Building Products"; Ice and Water Shield.
2. “Soprema”; Lastobond.
3. “Mid-States Asphalt”; Quik-Stick HT.
4. “InterWrap”; Titanium UDL.
5. “DMI”; Ultra HT Wind and Water Seal.

B. Provide beneath entire finished roof surface or as otherwise indicated on Drawings.

C. If not indicated on Drawings at all, provide at the following minimum locations:
a. Eave Edges:
Install from the eave’s edge to 24” minimum distance inside the exterior wall line of the building.
b. Valleys: Install minimum 36” wide strip.
c. Ridges: Install minimum 12” wide strip.
d. Remaining areas to be 30# asphalt saturated felt complying with the requirements of ASTM D226, or as otherwise indicated on Drawings.

2.05 DRAINAGE AND VENTILATION MAT

A. Provide one of the following approved products:
1. "Bonar, Inc."; Enkamat ASV 7010.
2. “Rheinzink”; Air-Z.

B. Provide beneath entire finished roof surface, atop the underlayment, whether indicated on the Drawings or not.

C. Mat consisting of a nylon core of fused, entangled filaments.

2.06 SNOW GUARD SYSTEM

A. Provide one of the following approved products:
   1. "Alpine SnowGuards", SnowMax.
   2. “S-5!”; ColorGard.

B. Description:
   1. Clamp to the seam, single cross member aluminum snowguard system for standing seam roofs.
   2. Block and flag assembly brackets attach directly over the standing seam batten and are secured via set screws.
   3. Spacing of brackets to be per the manufacturer's requirements for retained snow loads and warranty, but no further than 48 inches o.c.
   4. Single, flat, 2” high cross member spanning perpendicular to the standing seam battens and attaching to each bracket.
   5. Provide prefinished color strip infill panel to insert into the visible face of the cross member. Color to match roofing panel.
   6. System shall engage the seam for a secure installation, but not penetrate the roof panel or any other component of the roof system.
   7. Provide all required fasteners and components complete.

C. Additional Requirements:
   1. Provide the appropriate snowguard, block and flag assembly, brackets, fasteners, clamps, tubing, couplings, plugs, caps, flags, collars, components and accessories as required for the roof system.
   2. Verify compatibility of the clamps and brackets with the size, shape, profile and configuration of the roof panels and battens for a proper installation.
   3. Manufacturer of roofing system shall approve the snow guard system as not voiding any of the warranty requirements of the roofing system.

D. Finish:
   1. All components to be powder coated finish, all exposed surfaces, items and components.
   2. Color to match roof system panels.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine conditions under which roofing is to be installed. Do no proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install roof system in accordance with manufacturer's instructions and approved shop drawing details.

B. System shall be capable of accommodating out-of-square and out-of-plumb conditions normally encountered in building construction.

C. Do not use seaming tools that will damage panel finish.

D. Remove stripable, protective vinyl film immediately after installation.

3.03 CLEANING

A. Clean grease, finger marks or stains from the panels per manufacturer's recommendations.

B. Remove all scrap and construction debris associated with roofing from the site.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Samples.
3. Shop Drawings.
4. Warranty.

END OF SECTION 07615

SECTION 07650 - FLEXIBLE 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. "AFCO" Cop-A-Bond Duplex.
2. "York Manufacturing" Cop-R-Tex Duplex.
3. "Advanced Building Products" Cop-R-Kraft Duplex.

2.02 MATERIAL
A. Copper:
1. Full sheet copper.
2. 2 oz. per square foot.
3. Bonded on both sides with kraft paper and asphalt, waterproofed.

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 07650

SECTION 07840 - FIRESTOPPING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Firestopping for fire-rated construction, this includes:
   1. All openings in fire rated wall assembles, both blank (empty) and those accommodating penetrating items such as cables, conduits, pipes ducts, etc.
   2. Gaps (openings) between exterior entrys, storefronts and curtain walls and the outer perimeter edge of the structural floor.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 03300 - Cast-In-Place Concrete
Section 03410 - Prestressed/Precast Concrete/Hollow Core Wall Panels
Section 03415 - Prestressed/Precast Concrete/Hollow Core Slabs
Section 04220 - Concrete Unit Masonry
Section 07900 - Joint Sealers
Section 09250 - Gypsum Drywall – Metal Stud Construction
Division 15 - Mechanical, Plumbing and Sheet Metal
Division 16 - Electrical Work

1.03 REFERENCES

A. American Society for Testing and Material Standards (ASTM):
   1. ASTM E814-88: Standard Test method for Fire Tests of Through-Penetration Firestops.

B. Underwriters Laboratories, Inc. (UL):
   1. UL 1479 Fire Tests of Through Penetration Firestops (Consult UL Fire Resistance Directory).

1.04 QUALITY ASSURANCE

A. Firestopping systems (materials and design) shall conform to both Flame (F) and Temperature (T) ratings as required by local building code and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.

B. Firestopping materials and systems must be capable of closing or filling through-openings created by:
   1. The burning or melting of combustible pipes, cable jacketing, or pipe insulating materials, or
   2. Deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).

C. Firestopping material shall be asbestos free and shall not incorporate nor require the use of hazardous solvents.

D. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

E. Do not use any firestopping products which after curing dissolve in water.

F. All firestopping materials shall be manufactured by one manufacturer (to the maximum extent possible).

G. Installation of Firestopping systems shall be performed by a contractor (or contractors) trained or approved by the Firestop manufacturer.

H. Installation of firestopping systems shall be performed by a contractor (or contractors) trained or approved by the firestopping manufacturer.

I. Equipment used shall be in accordance with the Manufacturer's written installation instructions.

1.05 SUBMITTALS

A. Manufacturer's Data Sheets:
   1. Submit manufacturer's product literature for each type of firestopping material to be installed. Literature shall indicate product characteristics, typical uses, performance and limitation criteria and test data.
   2. Material Safety Data Sheets (MSDS) for each firestop product.
   3. Submit manufacturer's installation procedures for each type of product.

B. Shop Drawings:
   1. Show typical installation details for the methods of installation.
   2. Indicate which firestop materials will be used, where, and thickness for different hourly ratings.

C. UL Test Data:
   1. Submit UL test data sheet and assembly information.
   2. Identify by UL number the system for which the product comprises, or is a part of.
   3. Identify approved tested hourly rating.
   4. Identify flame (F) and temperature (T) ratings.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver material in the manufacturer's original, unopened containers or packages with the manufacturer's name, product identification, lot number, UL label and mixing and installation instructions as applicable.

B. Store materials in the original, unopened containers or packages, or under conditions recommended by the manufacturer.

C. All firestopping materials shall be installed prior to expiration of shelf life.

1.07 PROJECT CONDITIONS

A. Conform to Manufacturer's printed instructions for installation and when applicable, curing in accordance with temperature and humidity. Conform to ventilation and safety requirements.

1.08 SEQUENCING

A. Coordinate this work as required with the work of other trades.

B. Firestopping shall precede gypsum board finishing.

1.09 PROTECTION

A. Where firestopping is installed at locations which will remain exposed in the completed work, provide protection as necessary to prevent damage to adjacent surfaces and finishes, and protect as necessary against damage from other construction activities.

PART 2 - PRODUCTS

2.01 GENERAL

A. Firestopping materials and systems shall meet the requirements specified herein.

B. Architect must approve in writing any alternates to the materials and systems specified herein.

C. All firestop products and systems shall be designed and installed so the basic sealing system will allow the full restoration of the thermal and fire resistance properties of the barrier being penetrated with minimal repair if penetrants are subsequently removed.

2.02 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, by one of the following approved manufacturers:
1. "Specified Technologies Inc." (STI)
2. "Dow Corning Corp." (Dow)
3. "3M Fire Protection Products" (3M)

2.03 MATERIALS

A. Firestop Mortar:
1. "STI", SpecSeal Mortar.

B. Firestop Sealants and Caulks:
1. "STI SpecSeal Sealant
2. "Dow", Firestop Sealant No. 2000
3. "3M", CP25WB+ Caulk

C. Firestop Putty:
1. "STI", SpecSeal Firestop Putty Bars and Pads
2. "3M", MPS-2 Moldable putty Stix and Putty Pads

D. Firestop Collars:
1. "STI", SpecSeal Firestop Collars
2. "3M", PPD Collars

E. Wrap Strips:
1. "STI", SpecSeal Wrap Strip
2. "3M", FS-195 Wrap Strip

F. Accessories:
1. Forming/Damming Materials: Mineral fiberboard or other type recommended by Manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine the areas and conditions where firestoppings is to be installed and notify the Architect of conditions determined to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected by the contractor in a manner acceptable to the Architect.

B. Verify that environmental conditions are safe and suitable for installation of firestopping products.

3.02 CONDITIONS REQUIRING FIRESTOPPING

A. General:
1. All through-penetrations, construction gaps, joints and through openings occurring in, adjacent to or between fire-rated floor/ceilings
2. Insulation types specified in other Sections shall not be installed in lieu of firestopping material specified herein.
3. All combustible penetrants (I.E. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

3.03 INSTALLATION

A. General:
1. Installation of firestopping shall be preformed by a applicator/installer qualified and trained by the manufacturer. Installation shall be preformed in strict accordance with manufacturer's detailed installation procedures.
2. Apply firestopping in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
3. Coordinate with plumbing, mechanical, electrical and other trades to assure that all pipe, conduit, cable and other items which penetrate fire-rated construction have been permanently installed prior to installation of firestopping. Schedule and sequence the work to assure that partitions and other construction which would conceal penetrations are not erected prior to the installation of firestopping.
4. Unless specified and approved, all insulations used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.

B. Dam Construction:
1. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as permanent component of the firestopping system.

C. Field Quality Control:
1. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.
2. Follow safety procedures recommended in the Material Safety Data Sheets.
3. Finish surfaces of firestopping which are to remain exposed in the completed work to a uniform and level condition.
4. All areas of work must be accessible until inspection by the applicable Code Authorities.
5. Correct unacceptable firestops and provide additional inspection to verify compliance with this specification at no additional cost.

3.04 CLEANING

1. Removing spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.
2. Leave finished work in neat, clean condition with no evidence of spillovers or damage to adjacent surfaces.

SUBMITTAL CHECKLIST

1. Manufacturer's Data Sheets.
2 Shop Drawings.
3. UL Test Data.

END OF SECTION 07840

SECTION 07900 - 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.
3. Acoustical Sealants.
4. Acoustical Duct Gaskets.

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.
6. Acoustical partition walls joints and entire perimeter.
7. Mechanical ducts through acoustical partition walls.

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 15 and 16 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.

2.06 ACOUSTICAL SEALANTS

A. Description:
1. Sealant engineered for acoustical isolation in partition walls.
2. Non-hardening, non-cracking, non-skinning.
3. One-component butyl sealant.

B. Performance:
1. Flexibility:
Comply with ASTM C-711-72 for no cracking or loss of adhesion.
2. Weatherability:
Comply with ASTM D750-68 for no cracking, bleeding or loss of rubber characteristics.

C. Installation:
1. Install at the following locations and conditions in all interior acoustical partition walls, whether

specifically indicated or not on the drawings:

a. All perimeter joints of overall wall surface to adjacent construction.
b. All joints between individual wall panels.
c. All perimeter surfaces of items penetrating the wall surfaces.
d. All small openings or penetrations through wall surfaces.
e. Bedding all electrical receptacle and switch boxes into wall surface.
f. Along all edges of stud wall bottom plate to floor, both sides of wall, prior to install of wallboard.
g. Along all edges of stud wall top plate to ceiling or structure, both sides of wall, prior to install of wallboard.

D. Acceptable Products:
1. "QuietSeal", QS-350.
2. "Titebond", Acoustical Sound Sealant.
3. "Grabber", Acoustical Sealant GSCS.
4. “Lapage”, PL Acousti-Seal.

2.07 ACOUSTICAL DUCT GASKET

A. Description:
1. Flexible vinyl sheet bonded to a layer of reinforced aluminum foil on both faces engineered to reduce sound transmission where installed.
2. 0.10” (3mm) thick barium sulphate vinyl sheet.
3. Nominal density of 1.0 lbs/sf.
4. Minimum sound transmission loss STC=26.

B. Installation:
1. Install at all mechanical duct penetrations through all interior acoustical partition walls, whether specifically indicated or not on the drawings:
2. Wrap a single layer of material around the entire perimeter of the duct surface to form a complete barrier on surface through the entire wall thickness.
3. Material should carry continuously through the entire wall penetration.
Continue material on ductwork a minimum of 48” from the wall surface, both sides of wall where possible. Where not possible, end material edge flush with finished surface on front face side of wall.
4. Install additional layers of material through the entire wall thickness as required to completely infill the penetration void so as to create a tight gasket around ductwork through the wall penetration.

C. Acceptable Products:
1. "Kinetics Noise Control", #KNM-100AL/AL, Cross Talk Barrier Material.

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.
3. Additional Submittals for Concrete Tilt Walls.

END OF SECTION 07900

SECTION 08110 - 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 window-walls, glazed openings, and other hollow metal frames for glass.
   4. Rough bucks, frame reinforcing, door reinforcing, door insulation, closer reinforcements, clip angles and anchorage.
   5. Factory prime paint finish.
   6. Grouting of hollow metal frames with masonry mortar where not covered under other Sections.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 03300 - Cast-In-Place Concrete.
Section 04220 - Concrete Unit Masonry.
Section 06100 - Rough Carpentry.
Section 08211 - Flush Wood Doors.
Section 08710 - Finish Hardware.
Section 08800 - Glass and Glazing.
Section 09900 - Painting.

1.03 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.

1.04 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.

1.05 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.

1.06 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 any other area that is exposed to moisture for long periods of time.
d. 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 08710.

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 08110

SECTION 08211 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 06200 - Finish Carpentry.
Section 08110 - Steel Doors and Frames.
Section 08710 - Finish Hardware.
Section 08800 - Glass and Glazing.
Section 09900 - Painting.

1.03 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.

1.04 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 stairwell 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.

1.05 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.

1.06 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.

1.07 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. Fire Rated Doors (20 Minute Rating):
   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.

C. Fire Rated Doors (45 Minute Rating and Higher):
   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 mineral core (FD).
      a. Non-combustible mineral core containing no asbestos.
   5. Vertical Stiles: Laminated hardwood to match face veneer over mineral composite, glued to core, and laminated prior to field fitting.
   6. Rails: Fire-rated mineral composite materials (Firestop), as required by fire door authorities. Top and bottom: thickness before trimming as required by manufacturer’s fire door authorities. Meet requirements and testing for labeled rating.
   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.

D. Provide all blocking, backings and supports in all horizontal and vertical members as required for reinforcing of all door hardware as specified in Section 08710.

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: Natural Birch.
   4. Face Cut: Plain Sliced, as selected by Architect.
   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. Fire Rated Doors:
1. Provide UL rated frame. Match color of door face veneer.
2. Equal to: “Air Louvers”, “Slimline” lite kits with glazing.
3. Factory glaze doors using compatible veneered metal lite kits.

C. Glass:
1. Refer to drawings for type and thickness.
2. See Section 08800 - 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.
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.

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 08211

SECTION 08305 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 09900 - Painting
Division 15 - Mechanical Access Panels
Division 16 - Electrical Access Panels

1.03 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.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job in manufacturer's unopened packages with labels intact.

B. Store and handle produces so as to prevent damage. Remove all damaged items from the job site.

1.05 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 09900.

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 08305

SECTION 08360 - SECTIONAL OVERHEAD DOORS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Manual upward acting sectional type doors.
Work includes, but is not limited to, the following type doors:
1. Steel Doors - Insulated Thermal.

B. Work includes all labor, materials, accessories and hardware to furnish and install complete and operating door systems as indicated on the Drawings and specified herein.

1.02 SUBMITTALS

A. Product Data:
1. Manufacturer's published catalog information, product data sheets and cutsheets.
2. Manufacturer's instructions on installation, operation and maintenance.
3. Certification that springs have been tested and approved for specified higher cycles of use.

B. Shop Drawings:
1. Show locations, elevations, details and methods of anchorage.
2. Show all components for operators and utility connections and requirements.
3. Indicate clearances required for all components and proper operation.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store and handle so as to prevent damage.

PART 2 – PRODUCTS

2.01 STEEL DOORS – INSULATED THERMAL

A. Provide one of the following approved products:
1. Overhead Door Corporation", Thermacore 592 or equal.

B. Description:
1. Panel Sections: Rolled 20 gauge galvanized steel, ribbed exterior surface, rabetted meeting rails, full width interlocking, 2 inch nominal door thickness.
2. Center and End Stiles: Formed and welded so as to be integral with panels.
16 gauge center stile, 16 gauge channel shaped end stiles.
3. Tracks; Galvanized steel, 2 inches or 3 inches deep. High Lift track, unless otherwise indicated. (Standard Headroom) (Verify with Architect before order).
4. Track Supports: Intermediate vertical supports for horizontal track as required to properly secure track to be without excessive motion interfering with proper operation of the door or posing a detrimental effect on any other item or trade.
5. Hinges and Brackets: 14 gauge galvanized steel. Full floating ball-bearing rollers in case hardened steel races. Mounted to fit the taper of the track.
6. Weatherstripping: One piece, full length, at perimeter of opening jambs and header.
EPDM rubber header seal. Jamb weatherstripping.
7. Bottom Section: Full length extruded aluminum astragal retainer, galvanized steel step plate and U-shaped flexible astragal.
8. Finish: White, both sides. Prep to accept field paint.
9. Lock: Pin tumbler keyed mechanism.
Install universal cylinder and key to building master key system per Owner. (See Hardware Set)

10. NO Glazing.
11. Operation: Chain hoist type.
12. Springs: Higher cycle rated for 100K cycles.
13. Back Cover: 26 gauge galvanized steel.
14. Insulation: Polyurethane sandwiched between door panel faces (min.R-17.5).
15. Thermal: .08 cfm at 25 mph. PVC thermal break.
16. Additional Warranty: 10 year delamination.

2.02 HOIST OPERATOR – Manually Operated Unit

A. Description:
   1. Hand Pull Rope:
      a. Length to be within reach when door is open.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install plumb, square, level and true.

B. Provide treated wood blocking, steel angles, shims, brackets and all other accessories necessary for a complete and finished installation.

C. Paint all exposed wood blocking and shims. Do not paint weatherstripping.

D. Paint steel doors under Division 9.

E. Install door, track and all accessories per manufacturers requirements, unless less stringent than Drawings and Specifications.

3.02 CLEANING AND ADJUSTING

A. Upon completion, remove all materials, equipment and debris from the premises.

B. Just prior to substantial completion, clean and touch up all surfaces, and check doors for proper operation. Adjust as necessary for tight fit and proper operation.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.

END OF SECTION 08360

SECTION 08362 - FULL GLASS ALUMINUM SECTIONAL OVERHEAD DOORS - FIRE STATION OPERATION

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Motor operated upward acting full glass aluminum sectional type overhead doors with special options components, controls and operation per requirements for fire stations and apparatus rooms.

B. Work includes all labor, materials, accessories and hardware to furnish and install complete and operating door systems as indicated on the Drawings and specified here-in.

C. Special coordination is required with other components as indicated on the Drawings and specified herein, to assure proper connections and operation of lights, timers, indicators and operators.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's published catalog information, product data sheets and cutsheets.
   2. Manufacturer's instructions on installation, operation and maintenance.
   3. Certification that springs have been tested and approved for specified higher cycles of use.

B. Shop Drawings:
   1. Show locations, elevations, details and methods of anchorage.
   2. Show all components for operators and utility connections and requirements.
   3. Indicate clearances required for all components and proper operation.

1.03 DELIVERY, STORAGE AND HANDLING

A. Store and handle so as to prevent damage.

PART 2 – PRODUCTS

2.01 FULL GLASS ALUMINUM SECTIONAL OVERHEAD DOOR

A. Provide one of the following approved products:
   1. "Clopay Building Products Company, Inc.", Model 902.
   2. "Haas Door Company", Model CA-220.

B. Description:
   1. Type: 1-3/4 inches thick minimum, extruded aluminum.
   2. Material: 6053-T5 anodized aluminum with reinforcing integral fin.
   3. Section Joints: Sections to form a weather-tight shiplap fit.
   4. End Stiles: Manufacturer's nominal 3-1/2 inches wide.
   5. Center Stiles: Manufacturer's nominal 2 inches wide.
   6. Intermediate Rails: Manufacturer's nominal 2 inches wide.
   7. Enclosed Top and Bottom Rails: Manufacturer's nominal 3-1/2 inches wide.
   8. Frame Finish: Black Anodized. (Verify with Owner before order).
   9. Hinges and Brackets: 14 gauge galvanized steel. Full floating ball-bearing rollers in case hardened steel races. Mounted to fit the taper of the track.
   10. Springs: Higher cycle rated for 100K cycles.
   11. Cables: Pre-formed galvanized steel aircraft cable to provide a minimum safety factor of 7:1.
   12. Cable Drums: Die cast aluminum.
   13. Lock: Inside spring loaded slide bolt lock on end stile to securely engage slot in track. Secure in open position for use with electric operators.

14. Glass Panel Glazing: Provide manufacturer's standard insulated window units, 7/16" minimum total thickness, tempered safety glass, with rigid vinyl molding and butyl tape, unless otherwise indicated. Provide tinted glass as indicated.
15. Weatherstripping: Extruded vinyl. One piece, full length, at perimeter of opening jambs and header.
16. Bottom Section: Full length extruded aluminum astragal retainer, galvanized steel step plate and U-shaped flexible astragal.
17. Tracks: High Lift. Galvanized steel, 3 inches deep. Tapered and mounted for wedge type closing.
18. Track Supports: Intermediate vertical supports for horizontal track as required to properly secure track to be without excessive motion interfering with proper operation of the door or posing a detrimental effect on any other item or trade.
19. Operation: Electric motor operator.
20. Panel and Section Arrangement: Custom arrangements as indicated on Drawings.

2.02 HOIST OPERATOR

A. Provide one of the following approved products:
   1. "Chamberlain", Lift Master Professional Model H.

B. Hoist Operator System:
   1. Description:
      a. Industrial-duty hoist operator.
      b. Continuous-duty high-starting torque motor.
      c. Universal mount frame design.
      d. Industrial ball bearings on the output shaft.
   2. Electric Operator:
      a. Trolley, side or center mounted, per head room, side room and all clearance requirements.
      b. Horsepower, voltage, phase and speed calibration as required for proper operation and top meet requirements otherwise indicated on Drawings or specified herein.
   3. Door operation speed shall be calibrated between 8-12 inches per second.
   4. Logic Control Board and Cards:
      a. Solid State with ability to accept available plug-in option cards for extra desired features.
      b. Built-in radio receiver.
      c. Maintenance Alert System.
         Provides routine maintenance schedule based on number of cycles or calendar date. Includes self-diagnostic system for troubleshooting of error codes.
      d. Maximum run timer, delay-on-reverse circuit and programmable mid-stop.
      e. Option Card - Commercial Protector System with Timer-to-Close.
         To provide UL-approved self-monitoring operator when used in conjunction with the infrared safety reversing beam. To provide timer-to-close function. To provide support to the safety reversing edge.
      f. Option Card- Auxiliary Contact Option Board.
         To provide additional contacts to auxiliary security and warning devices.
      g. Option Card - Warning Device Option Board with Red/Green Warning Light Box.
         Contains a red/green warning light box and can be used for other auxiliary audible devices. To actuate a red light signal prior to an automatic timed close.
   5. Provide limit switches and coordinate operation to stop door operation upon actuation of device.

2.03 SAFETY PROVISIONS

A. Infrared Safety Reversing Beam:
   1. Reflector style angled across face of door opening.

B. Safety Reversing Edge:
   1. Fitted to bottom of door.
   2. Door to reverse to open position upon contact with object or obstruction.

C. Power Disconnection and Operation:
   1. Floor level chain hoist for emergency manual operation.
   2. Provide emergency manual operation using an electrically interlocked floor level disconnect.

2.04 TRAFFIC SIGNAL LIGHT

A. Provide one of the following approved products:
   1. "Signal Technologies Inc.", TCILH-225.

B. Traffic Signal Light:
   1. Direct-view, wide viewing angle LED fixtures.
   2. Mounted in a single pair-unit housing of impact-resistant polycarbonate with hood.
   3. 5-1/2 inch diameter red and green light lenses of impact-resistant polycarbonate.
   4. Provide red beacon when door is closed and during entire time door is in operation. Provide green beacon only when door is stationary and at full open position.
   5. Wall mount as and where directed. Surface or recessed in wall as directed.
   6. Rated for both interior and exterior applications.

2.05 CONTROLLERS

A. Push Button Control Station:
   1. Mounted at floor level as and where directed.
   2. Flush or surface mount as directed by Architect, unless otherwise indicated.
   3. Three button position - Open, Close, Stop.

B. Radio Receiver/Transmitter:
   1. Remote 3-button radio transmitter for operation of door - Open, Close, Stop.
   2. Provide three (3) transmitters per door opening.

C. Provide coordination to any timed closers, photoelectric sensors and access control devices.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install plumb, square, level and true.

B. Provide treated wood blocking, steel angles, shims, brackets and all other accessories necessary for a complete and finished installation.

C. Paint all exposed wood blocking and shims. Do not paint weatherstripping.

D. Install door, track and all accessories per manufacturers requirements, unless less stringent than Drawings and Specifications.

E. Install wiring, conduits, fittings, boxes, contactors and connections for all automatic operators, lights, timers, indicators, controls, etc. under Division 16.

F. Provide connections and coordination to all provided and auxiliary devices for proper operation of all door unit with all lights, operators, controllers and the like. Provide to operate as intended as a full unified and integrated system.

3.02 CLEANING AND ADJUSTING

A. Upon completion, remove all materials, equipment and debris from the premises.

B. Just prior to substantial completion, clean and touch up all surfaces, and check doors for proper operation. Adjust as necessary for tight fit and proper operation.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.

END OF SECTION 08362

SECTION 08410 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 07900 - Joint Sealers
Section 08520 - Aluminum Windows
Section 08710 - Finish Hardware
Section 08800 - Glass and Glazing

1.03 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.

1.04 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.

1.05 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 from the job site.

1.06 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, 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.

2.02 MATERIALS

A. Aluminum Extrusions:
1. ASTM B 221.
2. Alloy 6063-T5.
3. Finish: Class 1 Anodic Coating with integral Black color, AA-M12-C22.
Color to be selected from manufacturer's entire custom color selection.

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 08800 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 08800.

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 07900.

J. Backup Joint Filler:
   1. Closed-cell expanded polyethylene, as specified in Section 07900.

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 08710.

Q. Hardware:
   1. See Section 08710 – Finish Hardware for all other items not listed herein.

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 08710.
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 08710.
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 08710.
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 an 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 08800.

SUBMITTAL CHECKLIST

1. Shop Drawings.
2. Samples.
3. Test Reports.
4. Warranty.

END OF SECTION 08410

SECTION 08520 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 07900 - Joint Sealers
Section 08410 - Aluminum Entrances and Storefronts
Section 08800 - Glass and Glazing

1.03 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.

1.04 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.

1.05 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, 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 inswing (hopper), unless otherwise indicated on Drawings. (Verify with Architect before order).

2.02 MATERIALS

A. Aluminum Extrusions:
   1. ASTM B 221.
   2. Alloy 6063-T5.
   3. Finish: Class 1 Anodic Coating with integral Black color, AA-M12-C22.
   4. Color: Color to be selected from manufacturer's entire custom color selection.

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 08800 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.

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. Seal 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 where 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 08520

SECTION 08710 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 01400 - Quality Control
Section 03300 - Cast-in-Place Concrete
Section 04220 - Concrete Unit Masonry
Section 06100 - Rough Carpentry
Section 07900 - Joint Sealers
Section 08110 - Steel Doors and Frames
Section 08211 - Flush Wood Doors
Section 08410 - Aluminum Entrances and Storefronts
Section 08800 - Glass and Glazing
Section 09900 - Painting
Section 13850 - Fire Detection and Alarm System
Division 16: Electrical components, connections, and coordination
Section 17130 - Horizontal Cabling.
Section 17920 - Access Control System
Electrical Drawing
Technology Drawings

1.05 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.

1.06 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.

1.07 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.

1.08 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.

1.09 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.

1.10 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: Lifetime.
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.

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 from the same master keying system. Key cylinders in dogged panic devices, keyed removable mullions, coiling doors, overhead doors, etc. to match building master keying system.

2.03 FINISHES

A. All finishes, typical, are to be:
“Matt” or “Satin” Black US19 (622) Finish (finish to be reviewed by Architect before ordering) unless otherwise indicated. Materials unable to have this finish applied are to have a finish to closely match and compliment

B. 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.

C. 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 (Cylindrical):	(Grade 1) Schlage, Falcon, Best, Sargent, Hager, Dorma, Yale
Deadbolts: (Outdoor Storage Building Only)	Schlage, Falcon, Best, Sargent, Hager, Dorma, Yale
Cylinders:	“Falcon” to match Fire Station No. 2
Panic Devices:	(Premium Tier, Extra Security) Von Duprin
Push/Pulls:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Surface Closers:	(Premium Tier) LCN, Sargent
Wall/Floor Stops:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Wall/Floor Holders:	Ives, Glynn-Johnson, Hager, Rockwood, Trimco
Thresholds:	Hager, NGP, Pemko, Reese, Zero
Seals/Gaskets/Sweeps/Bottoms:	Hager, NGP, Pemko, Reese, Zero
Overhead Drip Guards: (Provide at all single exterior doors)	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
   (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.
4. 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.
5. 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.
6. 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.
7. 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.
8. 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 (Cylindrical): (Compatible w/Falcon Cylinder and interchangeable core system utilized at Fire Station No. 2).
1. All heavy-duty Grade 1 cylindrical locksets shall be one of the following:
   a. Schlage, ND Series, "Rhodes" lever and escutcheon.
   b. Falcon, T Series, “Dane” lever and escutcheon.
   c. Best, 9K Series, "15" lever and "D" escutcheon.
   d. Sargent, 11 Line TZONE Series, "L" lever and escutcheon.
   e. Sargent, 10 Line Series, "L" lever and escutcheon.
   f. Hager, 3400 Series, “Withnell” lever and escutcheon.
   g. Dorma, CL800 Series, “LR” lever and escutcheon.
   h. Yale, 4700(LN) Series, “Augusta AU” lever and escutcheon.
   i. Stanley, QCL 100 Series, “Sierra E” lever and escutcheon.
2. All locksets shall have 2-3/4" backset with appropriate standard strike package.
3. All other conditions, function and operation as selected by Owner from all manufacturer's available.

D. Deadbolts (Cylindrical, when no mortise set is present): (Outdoor Storage Building Only)
1. All heavy-duty Grade 1 deadbolts shall be one of the following:
   a. Schlage, B560 Series.
   b. Falcon, D100 Series.

c. Best, T Series.
d. Sargent, 34 Series.
e. Sargent, 480 Series.
f. Hager, 3100 Series.
g. Dorma, D800 Series.
h. Yale, 3500 Series.

2. Provide with standard backset and high security dead latching lockbolt.
3. Deadbolts from public rooms shall be equipped with anti-throw capabilities such that the latch cannot be thrown from the interior side of the room. Operation of the inside ADA compliant thumbturn shall allow the locked deadbolt to unlatch without the use of a key.
4. All other conditions, function and operation as selected by Owner from all manufacturer's available.

E. Panic Devices (Rim Type): (Premium Tier, Extra Security)
1. All non-electrified panics shall be one of the following:
a. Von Duprin, 99 Series, “06” lever design.
2. Provide option for two-piece latch bolt at all exterior entry door locations.
The tapered section of the latch bolt recedes and the remaining section forms a 90 degree angle to the strike pad, making the latch more secure to entry shall be one of the following:
a. Von Duprin, XP 99 option.
3. 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.
4. Where Door Pulls are scheduled, provide Ives 8190, 90 degree offset pull.
12” center-to-center x 1” diameter x 3-1/4” projection, concealed mounting, brass.
5. All exterior doors to receive locking cylinders with night latch function, unless indicated otherwise.
6. Provide Cylinder Dogging on all devices, unless specifically indicated otherwise.
7. Provide cylinders for all panic devices to be compatible for brand of locksets provided and/or for building’s master keying system.
8. Provide fire rated devices for all rated door assemblies.
9. Exterior panic doors to have universal function, adjustable in the field for operation as desired.
10. All other conditions, function and operation as selected by Owner from all manufacturer's available.
11. 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.
12. 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.
13. 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.
14. All devices to incorporate a security dead-latching feature.

F. Electrified Panic Devices: (Premium Tier)
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 EL Electric Latch Retraction option to allow for a control station actuator (key switch, credential reader, etc.) to remotely unlatch and retract the latch bolt.
3. Provide SD-EL Special Center Case Dogging for cylinder dogging capability.
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.
6. Provide equal to Von Duprin PS914 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.

7. Provide equal to Von Duprin E996L electrified Lever Trim with cylinder operation for night latch function on all devices, unless indicated otherwise.
8. Where Door Pulls are scheduled, provide Ives 8190, 90 degree offset pull.
   12" center-to-center x 1" diameter x 3-1/4" projection, concealed mounting, brass.
9. 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.

G. Push/Pulls:
   1. All push plates shall be Hager, A40R, size: 6"x16", brass.
   2. All pulls shall be Hager, 9G, brass.
   3. All flush cup pulls shall be Hager, 17N, brass.

H. Surface Closers: (Premium Tier)
   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.

I. 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.

J. 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.

K. 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.

L. 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.

M. 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.

N. Seals/Gaskets (used for Fire and Smoke Seals):
1. All fire and smoke seals shall be one of the following:
   a. Pemko, HSS2000 Series.

2. High temperature silicone, self-extinguishing and non-toxic.
3. Full length and width of opening at each condition.
4. Provide fire and smoke seal sets at entire perimeter jambs and head as required.

O. 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 black anodized finish as applicable to match aluminum door.
   If not an aluminum door, match all other hardware.
4. Install drip strip along top edge of all exterior doors, whether scheduled or not.
   Apply sealant along top edge.

P. 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.

Q. 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.

R. 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.

S. 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.

T. 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.

U. Access Control Door Controllers:
1. Specified in Section 17920 - Access Control System.

V. Access Control Credential Readers:
1. Specified in Section 17920 - Access Control System.

W. Access Control Remote Entry and Camera System:
1. Specified in Section 17920 - Access Control System.

2.06 **Hardware Set #1 (Interior, Single, Office, Sound)**
Hinges
Lockset – Office/Storage Function
Cylinder
Kick Plate
Wallstop
Sound Seals/Gaskets
Automatic Door Bottom

Hardware Set #2 (Interior, Single, Storage/Utility)
Hinges
Lockset – Office/Storage Function
Cylinder
Kick Plate
Wallstop

Hardware Set #3 (Interior, Single, Non-Locking, Sound)
Hinges
Lockset – Passage Function
Kick Plate
Wallstop
Sound Seals/Gaskets
Automatic Door Bottom

Hardware Set #4 (Exterior, Single, Panel, Access Control)
Continuous Hinge
Electrified Panic Device
Power Transfer
Door Pull
Cylinder
Closer
Kick Plate
Heavy-Duty Floor Stop
Threshold
Weatherstripping
Position Switch
Proximity Reader
Access Control Enclosures
Drip Guard

Hardware Set #5 (Interior, Single, Restroom)
Hinges
Push Plate
Pull Plate
Closer
Kick Plate
Wallstop

Hardware Set #6 (Interior, Single, Shower)
Hinges
Lockset – Privacy Function
Cylinder w/ Occupied/Unoccupied Signage Option
Kick Plate
Wallstop

Hardware Set #7 (Interior, Single, Panic, Access Control)
Continuous Hinge
Electrified Panic Devices
Power Transfer
Lever Trim
Cylinder
Closer
Kick Plate
Wallstop
Position Switch
Proximity Reader
Access Control Enclosures

Hardware Set #8 (Interior, Single, Storage/Utility)
Hinges
Lockset – Office/Storage Function
Cylinder
Kick Plate
Wallstop
Sound Seals/Gaskets
Automatic Door Bottom

Hardware Set #9 (Interior, Single, Apparatus, Sound)
Hinges
Panic Devices
Cylinder
Closer
Kick Plate
Sound Seals/Gaskets
Automatic Door Bottom

Hardware Set #10 (Interior, Single, Gear Room)
Hinges
Push Plate
Pull Plate
Closer
Kick Plate
Wallstop

Hardware Set #11 (Interior, Single, Restroom)
Hinges
Lockset – Privacy Function
Cylinder
Closer
Kick Plate
Wallstop

Hardware Set #12 (Exterior, Single, Panel, Access Control)
Continuous Hinge
Electrified Panic Device
Power Transfer
Door Pull
Cylinder
Closer
Kick Plate
Heavy-Duty Floor Stop
Threshold
Weatherstripping
Position Switch
Proximity Reader
Access Control Enclosures
Drip Guard

Hardware Set #13 (Interior, Single, Panic)
Continuous Hinge
Electrified Panic Device
Power Transfer
Door Pull
Cylinder
Closer
KickPlate
Heavy-Duty Floor Stop
Threshold
Weatherstripping

Hardware Set #14 (Interior, Single, Access Control, Evidence Room)
Continuous Hinge
Power Transfer
Lockset Office/Storage Function
Cylinder
Closer
Kick Plate
Wallstop
Position Switch
Proximity Reader
Access Control Enclosures

Hardware Set #15 (Exterior, Full Glass, Aluminum Sectional Overhead Doors)
See Specification Section 08362 – Full Glass Aluminum Sectional Overhead Doors for Door Hardware.

Hardware Set #16 (Exterior, Sectional Overhead Doors)
See Specification Section 08360 –Sectional Overhead Doors for Door Hardware.

Hardware Set #17 (Exterior, Single, Outdoor Storage Building)
Continuous Hinge
Lockset – Storage Function
Deadbolt
Heavy-Duty Floor Stop
Weatherstripping
Overhead Drip Guard
Floor Holder
Armor 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 08710

SECTION 08800 - GLASS AND GLAZING

PART 1 - GENERAL

1.01 WORK INCLUDED
A. Glass and glazing as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE
Section 06200 - Finish Carpentry
Section 08110 - Steel Doors and Frames
Section 08211 - Flush Wood Doors
Section 08410 - Aluminum Entrances and Storefronts
Section 08520 - Aluminum Windows

1.03 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.

1.04 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.

1.05 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.

1.06 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.

1.07 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: (Provide on all exterior glass lites).
   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. Fire-Resistant Rated Glass:
1. Fire-resistant and rated glass-ceramic with surface-applied film for use in applications with fire rating requirements.
2. When required to be safety glass, provide (2) lites of equal thickness of glass laminated with an approved polyvinyl interlayer to meet and maintain the required rating performance criteria.
3. Meet requirements for specific applications as required by Code, per IBC Tables 716.3 and 716.5.
4. When a fire-resistant glass is required for stoppage of fire and smoke, and is also required to stop the transmittance of radiant heat.
   Provide one of the following approved products, or an approved equal:
   a. “AGC”, Pyrobel.
5. When a fire-resistant glass is required for stoppage of fire and smoke, but not required to stop the transmittance of radiant heat, and not required to be safety glass.
   Provide one of the following approved products, or an approved equal:
   a. “AGC”, Schott Pyran Platinum F.
6. When a fire-resistant glass is required for stoppage of fire and smoke, but not required to stop the transmittance of radiant heat, and is required to be safety glass.
   Provide one of the following approved products, or an approved equal:
   a. “AGC”, Schott Pyran Platinum L.

G. G. Obscured Glass:
1. Thickness: 6MM.
2. Clear float glass with integral texture so as to provide visual privacy via glass surface obscuration.
3. Texture to be as indicated or as selected by Architect from manufacturer's entire selection.
4. Provide one of the following approved products, or an approved equal:
   a. “AGC”, Krystal Patterns, “Pebbles”, tempered.

H. 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.

I. 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 08800

SECTION 09200 - LATH AND PLASTER

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Metal furring and lathing.

B. Portland Cement Plastering.

1.02 QUALITY ASSURANCE

A. Portland Cement Plastering Standards:
   1. ANSI A 42.4.
   2. ANSI A 42.3.

B. Allowable Tolerances:
   1. For flat surfaces, do not exceed 1/8 inch in 8'-0" for bow or warp of surface, and for plumb or level.

1.03 SUBMITTALS

A. Product Data:
   1. Submit manufacturer's product specifications and installation instructions for each material, including other data as may be required to show compliance with these specifications.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver all manufactured materials in original unopened packages, bundles, or containers bearing manufacturer's label and brand name.

B. Storage:
   1. Keep cementitious materials dry until used.
   2. Store off ground, under cover in a dry location.
   3. Protect metal goods from rusting.

1.05 JOB CONDITIONS

A. Environmental Conditions:
   1. Comply with referenced standards.

B. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects which might result from plastering.

C. Scaffolding:
   1. Construct and maintain in strict conformity with applicable laws and ordinances and in such a manner as not to interfere with or obstruct work of others.

PART 2 - PRODUCTS

2.01 METAL SUPPORT, FURRING, LATHING AND ACCESSORY MATERIALS

A. Metals and Finishes:
   1. Manufacturer's standard steel products unless indicated as zinc alloy or other metal.
   2. Provide manufacturer's standard galvanized finish on steel products.

B. Interior Components:
   1. Hot-dip galvanized finish.

2. ASTM A 525 G90 for 18 gauge and lighter formed metal products.
3. ASTM A 123 galvanized after fabrication for 16 gauge and heavier products.

C. Interior Exposed Plastering Accessories:
1. Provide zinc alloy accessories for exterior work.

D. Wire Ties:
1. Galvanized soft steel wire.

2.02 METAL LATHING MATERIALS

A. Where not otherwise indicated, comply with MLSFA "Technical Bulletin 101" and ASTM C841 for selection of metal lath for each application indicated.

B. Interior Galvanized Diamond Mesh Lath:
1. 3.4 lbs per sq. yd., diamond mesh openings (approximately 11,000 meshes per square yard), with black asphaltum paint coating.

C. Metal Plastering Accessories and Reinforcement:
1. Coordinate depth of accessory with thickness of and number of coats of plaster to be applied.
2. Small-Nose Corner Beads:
a. General purpose type with expanded or perforated flanges.
3. Interior Corner Trim:
a. Manufacturer's standard preformed interior corner reinforcement made from 2.5 lb. per sq. yd. diamond mesh lath.
4. Square Edge Casing Beads:
a. Manufacturer's standard with expanded or short flange to suit application.
5. Control Joints:
a. "Keene", "Insuljoint I-DV", 1/4 inch, zinc, or approved equivalent.
6. Corner Reinforcement:
a. Special stucco-type woven galvanized wire corner reinforcing strips.
7. Line Wire:
a. 18 gauge soft annealed steel wire.
8. Fasteners:
a. Galvanized steel, of type and length suitable for adequate penetration of substrate.
9. Soffit Vents:
a. "MM Systems", two piece soffit expansion trim, 3 inches wide vented style (#SETV-34-300-58) or approved equivalent.
10. Plaster Column Rings:
a. "MM Systems", "Dura-Trim", or approved equivalent, extruded aluminum, 6063 T5 Alloy, .045 wall thickness, finish-white.
11. Drip Cap:
a. Manufacturer's standard, galvanized steel, expansion joint type for ceiling to fascia transitions.

2.03 PORTLAND CEMENT PLASTER MATERIALS

A. Provide either neat or ready-mixed (where applicable) materials, at installer's option, complying with ANSI A 42.2.

B. Base Coat Cement:
1. Portland Cement, ASTM C 150, Type I or IA.

C. Prepared Finish-Coat:
1. Factory-prepared finish for Portland Cement plaster, type recommended by the manufacturer for the color and texture indicated.

D. Texture:
1. Interior: Smooth.

E. Color: Finish white or as otherwise indicated on Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ceiling Anchorages:
1. Coordinate work with structural ceiling work to insure that inserts and other structural anchorage provisions have been installed to receive soffit hangers.
2. Furnish inserts, steel deck hanger clip and similar devices to other trades for installation well in advance of time needed for coordination with other work.

3.02 INSTALLATION OF METAL SUPPORT SYSTEMS

A. General Isolation:
1. Where work abuts overhead structure, isolate the work from structural movement sufficiently to prevent transfer of loading into the work from the building structure. Install slip or cushion type joints to absorb deflections but maintain lateral support.
2. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

B. Metal Lathing:
1. Install metal lath to comply with referenced standards.
2. Clip lath to supports, except at location where screw-attachment of lath is indicated or required to comply with manufacturer's recommendations.

C. Plastering Accessories:
1. Anchor each flange of accessories 8 inches o.c. to plaster base.
2. Miter or cope accessory corners, and install with tight joints accurately aligned.
3. Set accessories plumb, level and true to line, with a tolerance of 1/8 inch in 10'-0".
4. Install metal corner beads at external corners.
5. Install casing beads at terminations of plaster work, except where plaster is indicated to pass through other work and be concealed by lapping work, and except where special screens, bases or frames act as casing beads.
6. Install prefabricated expansion joints of 2-piece design where shown as "Expansion Joint"; 3/8 inch joint width for exterior work.

3.03 INSTALLATION OF PLASTER

A. Mechanically mix plaster materials at the project site; do not hand mix except where small amount is needed, using less than one bag of plaster.

B. Do not use frozen, caked or lumpy material, retempered or partially set plaster.

C. Sequence plaster installation properly with the installation and protection of other work, so that neither will be damaged by the installation of the other.

D. Plaster flush with metal frames and other built-in metal items and accessories which act as a plaster ground, unless otherwise shown. Where plaster is not terminated at metal by casing beads, cut base-coat free from metal before plaster sets and groove finish coat at the junctures with metal.

E. Apply thicknesses and number of coats of plaster as indicated; or as required by referenced standards.
   1. Provide 3-coat plaster installation.
   2. Provide additional coats if required for acceptable surface.

F. Cure Portland Cement plaster by maintaining each coat in a moist condition for 2 days following application.

3.04 CUTTING AND PATCHING

A. Cut, patch, point-up and repair plaster as necessary to accommodate other work and to restore cracks, dents and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs efflorescence, sweat-outs and similar defects, including areas of the work which do not comply with specified tolerances, and where bond to the substrate has failed.

3.05 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from surfaces which are not to be plastered. Repair floors, walls and other surfaces which have been stained, marred or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers and equipment and clean floors of plaster debris.

B. Protect plaster deterioration and damage during the remainder of the construction period.

SUBMITTAL CHECKLIST

1. Product Data.

END OF SECTION 09200

SECTION 09250 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 - Rough Carpentry
Section 07200 - Insulation
Section 08110 - Steel Doors and Frames
Section 09900 - Painting

1.03 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.

1.04 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.

1.05 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.

1.06 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 (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.

C. 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 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 18 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 4 finish at all exposed areas.
2. Level 2 finish at concealed areas (above ceilings, draftstopping).
3. No textured walls or ceilings.

3.02 CLEANING

A. Remove soil, stain caused by drywall installation.

SUBMITTAL CHECKLIST

1. Product Data.

END OF SECTION 09250

SECTION 09300 - 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.
4. Glazed ceramic 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 01610.

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 01781 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01780 - 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. "Dal-Tile Corp."
B. “American Olean”.
C. “Crossville”.

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 CERAMIC TILE

A. Glazed Ceramic 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.

2.05 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.

c. Height to match the thickness of the tile, with top surface smooth and flush with the tile.

3. Finish:
   a. White zinc, aluminum or stainless steel.
   b. Finish as selected from all manufacturer's standard selection.

2.06 TRIMMERS

A. Provide necessary caps, stops, returns, trimmers and other shapes to complete installation.

2.07 MORTAR MATERIALS - THIN SET BEDS

A. Portland Cement With Latex Additive; Thin-Set:
   1. Provide one of the following acceptable products:
      a. "Custom Building Products", CustomCrete Latex Mortar Admix with site mixed Mortar or CreteMix.
      b. "Laticrete, 4237 Latex Thin Set Mortar Additive.
      c. "Mapei, Keracrete System, consisting of KER 303 Latex mixed with 1:1 sand/cement blend.
   2. Description:
      a. Latex additive and site mixed portland cement mortar. Complying with ANSI A118.4.
   3. Quantity:
      a. As recommended by latex additive manufacturer.

B. Lightweight Portland Cement; Thin-Set (for use with large format 18" x 18" or larger floor tile):
   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.

2.08 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.

2.09 GROUT

A. Polymer- Modified Portland Cement
   1. Provide one of the following acceptable products:
      a. "Custom Building Products", Prism Color Consistent Grout.
   2. A lightweight, polymer-modified, cement-based grout that offers consistent color without mottling or shading. Composition is a blend of specialty cements, recycled aggregates and chemicals.
   3. Comply with ANSI A118.7
   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. Non-sanded grout must be used with glass tile and glazed ceramic wall tile.

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 09300

SECTION 09510 - 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.

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 01781 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01780 - 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:**
      (Lay-in, 2'x2', Drop Edge)
      a. Panel:
         1. Model: "USG", Frost #440.
         2. Size: 2' x 2' x 7/8".
         3. Edge: Shadowline Beveled.
         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.

2.03 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 09510

SECTION 09540 - FIBER REINFORCED PANELS

PART 1 - GENERAL

1.01 WORK INCLUDED
A. Fiberglass reinforced plastic coated panels as shown on drawings and specified herein.
1. Wall Panels.

1.02 RELATED WORK SPECIFIED ELSEWHERE
Section 06100 - Rough Carpentry
Section 09250 - Gypsum Drywall

1.03 QUALITY ASSURANCE
A. USDA accepted

B. FM Approved and UL Classified

PART 2 - PRODUCTS

2.01 WALLS PANELS
A. Kemlite AFire-X Glasboard@ panels.
1. 4= wide x length as required to extend from floor to ceiling without seams.
2. Class A (1) Flame Spread (max. 25 per ASTM E-84).
3. Color: as selected from manufacturer's complete range of color selections.
4. Surface Texture: Orange Peel
5. Fasteners and accessories as required for a complete installation.

PART 3 - EXECUTION

3.01 INSTALLATION
A. Install per manufacturer=s recommendations.

B. Install over gypsum wall board using Kemlite Titebond FRP adhesive.

C. Install moldings at all joints, set in silicone sealant.

D. Install matching trim on all exposed panel edges.

3.02 CLEANING PROTECTION
A. Clean as recommended by manufacturer.

END OF SECTION 09540

SECTION 09622 - RUBBER ATHLETIC FLOORING

PART 1 – GENERAL

1.01 WORK INCLUDED

A. Section Includes:
   1. Rubber Sports Flooring.
   2. Adhesive and accessories required for installation and maintenance.

B. Furnish labor, materials, equipment, special tools, supervision and services required to install the materials and system complete as shown on the Drawings and/or specified herein.

1.02 QUALITY ASSURANCE

A. The manufacturer must have experience in the manufacturing of prefabricated rubber surface.

B. Manufacturer shall be an established firm with a minimum of 10 years in business specializing in manufacturing prefabricated sheet rubber for athletic surfaces.

C. The complete installation of the flooring system shall be performed only by an experienced flooring contractor with a minimum three years of experience installing athletic surfaces and approved by the manufacturer.

1.03 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. 6” x 6” actual tiles of colors as specified on drawings. Color charts alone are not acceptable.
   2. If color is not specified, submit samples of manufacturer's entire selection.

C. Shop Drawings:
   1. Provide drawings illustrating layouts, details and dimensions, game and court lines.

D. Contractor is responsible for installation of a mock-up that must be deemed acceptable by Owner and Architect. Mock-up is to be installed following the same procedures and utilizing the same specified materials that will be used for the actual project.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Receive all materials as packaged by the manufacturer with manufacturer’s seals and labels intact.

B. Store material upright on a clean, dry, flat surface protected from exposure from all possible damage, and protect from exposure to harmful weather conditions.

C. Room temperature shall not be less than 55 F.

1.05 ENVIRONMENTAL CONDITIONS

A. Maintain a stable room and sub-floor temperature for a period of 48 hours prior, during and 48 hours after installation. Recommended range: 65 to 80 F.

B. Moisture vapor emission content of the concrete substrate must not exceed the tolerance of the adhesive used, when tested using the Calcium Chloride test as per ASTM F 1896-98.

1.06 WARRANTY

A. Provide manufacturer's standard limited warranty period of one (1) year from the date of substantial completion.

1.07 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 MATERIALS

A. Rubber Athletic Flooring:
1. Provide one of the following acceptable products:
   a. "Connor Sports", "PowerDek" Fleck.
2. Type: Prefabricated, calendered and vulcanized with a base of natural and synthetic rubbers, stabilizing agents and pigmentation per ASTM F-1344 Standard Specification for Rubber Floor Tile.
3. Thickness: 10mm.
4. Size: 24"x24" square edge tiles.
5. Static Coefficient of Friction: Meet or exceed wet friction rating of 0.80.
6. Finish: Sanded Smooth Finish.
7. Color to be as indicated on the Drawings.
   If not indicated, color to be selected by Architect from manufacturer's entire standard selection.
8. Two-component, polyurethane full spread adhesive as supplied by flooring manufacturer.

B. Concrete Slab Primers and Sealers:
1. Where slab's moisture content exceeds required acceptable installation levels:
   Provide primers and sealers as required by flooring manufacturer to achieve the proper moisture content on all concrete slabs and substrates for installation of flooring.
2. 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. Leveling Compound:
1. Latex type as recommended by flooring manufacturer.

D. 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.

PART 3 – EXECUTION

3.01 PREPARATION

A. Concrete substrates to be placed a minimum of thirty (30) days prior to the installation of flooring.

B. Verify concrete sealers and/or curing compounds used on concrete substrates are compatible with all manufacturer's products and installation guidelines.

C. Water vapor membrane complies with specification is ASTM E 1745-97.

D. Alkalinity test and moisture test must be performed.
   1. PH level should be in the range of 7 to 8.5.
   2. Moisture content must not exceed 5 lbs/1000 ft2 per 24 hours (verify using the calcium chloride test as per ASTM F 1869-98).

E. Substrate shall not have a change in elevation of more than 1/8" in a 10 foot radius.

F. Concrete substrates must be clean, free of paint, dust, sealer, hardeners, grease, oil, solvents, old adhesive and any other foreign substances that may act as a bond barrier. Clean and remove as required with products and measures as per manufacturer's recommendation.

G. Sealing of cracks and holes, and smoothing and leveling of rough, uneven surfaces, must be carried out using a good quality Portland cement based leveling compound approved by the manufacturer.

H. The beginning of installation stipulates the acceptance of surface and site conditions.

I. Surfaces to receive flooring shall meet the minimum requirements of the manufacturer. Make any and all preparations to substrate without delay and as per manufacturer.
No additional compensation will be granted for cleaning, sealing, patching or other substrate repairs.

J. Flooring work shall not be started until all items penetrating the flooring have been installed.

K. Spaces shall be closed to traffic or other work for period as per manufacturer's recommendations.

L. Adjust floor elevations at all material changes to allow standard transition strip.

M. Areas to receive flooring shall be fully enclosed, weathertight and maintained at a uniform temperature of at least 65 degrees F for 72 hours before installation begins.

3.02 INSTALLATION

A. Install flooring and products in accordance with the manufacturer's recommendations.

B. Apply substrate sealer and primer products as required to achieve the proper moisture content on all concrete slabs and substrates. Apply when areas are ready or scheduled to receive flooring without delays to the project or schedule, and without any additional costs.

C. Before installation, unroll flooring and allow relaxation.

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 in multiple directions using a 100lb roller to eliminate any trapped air and to assure contact and proper adhesion to substrate.

E. Install flooring in ashlar or brick pattern.

F. After rolling, and before adhesive dries, weight all seams and perimeter wall.

G. Apply wall base after flooring installation is complete.

H. Remove excessive adhesive in accordance with flooring manufacturer's instructions.

I. Install edge strips at termination of flooring where substrate is exposed and extends beyond.

J. After installation, maintain a minimum space temperature of 55 degrees F.

K. 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.

L. Allow adhesive to set 72 hours before the initial cleaning of the surface.

3.03 CLEANING

A. Contractor is responsible for Post-Installation – Initial Cleaning.
Initial floor cleaning should only be performed 72 hours after the rubber athletic flooring has been completely installed. Wash thoroughly, with a floor scrubber and cleaner as recommended by the flooring manufacturer, in accordance with flooring manufacturer's recommendations.

3.05 PROTECTION

A. Rubber athletic flooring surface can be protected with 1/8" masonite during and after installation, prior to acceptance by the Owner.

SUBMITTAL CHECKLIST

1. Manufacturer's Literature.
2. Samples.

END OF SECTION 09622

SECTION 09650 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Section Includes:
   1. Rubber Base.
   2. Luxury Vinyl Tile.
   3. Resilient flooring accessories.

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. 6”x6” 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 01781 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01780 - 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. “Johnsonite".
      b. “Roppe”.
      c. “Flexco”.

2. Luxury Vinyl Tile:
   a. “The Mohawk Group"

2.02 MATERIALS

A. Rubber Base:
   1. FS SS-W-40A, Type I, rubber.
   2. 1/8" thickness, 120' rolls, coved, set-on type.
   3. 4" high unless otherwise shown.
   4. Color: as shown on Drawings.

B. 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: .030” Clear.
   6. Overall Thickness: .120”/ 3mm (nominal).
   7. Warranty: 20-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. 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.

F. Leveling Compound:
   1. Latex type as recommended by flooring manufacturer.

G. 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.

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 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 manufacturer's recommended floor scrubber equipped with 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 09650

SECTION 09680 - 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 24 inch x 24 inch 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. Diagram indicating:
      a. Pattern direction and orientation.
      b. 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 01781 - Closeout Maintenance Materials.

B. Submit maintenance data under provisions of Section 01780 - 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. "Shaw Contract Group"

2.02 CARPET

A. Type:
1. Modular Carpet Tile products as indicated on the Drawings.
2. 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 03300.

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. Run all carpet seams in same direction.

C. Lay carpet with minimum number of seams using minimum carpet sections in each room or space.

D. Fit carpet neatly into breaks and recesses, against bases, around pipes and penetrations, under saddles and thresholds, and around permanent cabinets and equipment.

E. 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.

F. 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.

G. Roll carpet to remove air bubbles and insure bond.

H. 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 09680

SECTION 09900 - 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.

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 01781 - 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 PREPARTION

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. Wood Doors, Metal Doors and Metal Frames:
1. Apply one coat of paint to glazing stops and rabbets prior to glazing.

H. Insulated Coverings:
1. Remove dirt, grease and oil from canvas and cotton.

I. 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.

J. 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.

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 15 and Division 16 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, 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.

B. 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.

C. 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.

3.10 PAINT SYSTEM SCHEDULE - INTERIOR PAINT SYSTEMS

A. CONCRETE MASONRY UNITS (interior, new construction, painted finish):
1st Coat - Acrylic Block Filler
"S-W, Heavy-Duty Block Filler, Interior/Exterior Acrylic, B42W46"
*Apply filler coat at a rate to ensure complete coverage with pores filled.

2nd Coat - Interior Latex Topcoat
"S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

3rd Coat - Interior Latex Topcoat
"S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

B. 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.

C. 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.

D. 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.

E. 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.

F. GYPSUM DRYWALL / PLASTER WALL SURFACES (interior, new construction, painted finish):
1st Coat - Latex Primer
"S-W, ProMar 200 Zero VOC, Interior Latex Primer, B28W02600"
*Tinted toward final color.

2nd Coat - Interior Latex Topcoat
"S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

3rd Coat - Interior Latex Topcoat
"S-W, ProMar 200 Zero VOC, Interior Latex, Eg-Shel"

G. 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 "

H. INSULATED COVERINGS - CANVAS (interior, new construction, painted finish):
1st Coat - Latex Primer
"S-W, ProMar 200 Zero VOC, Interior Latex Primer, B28W02600"

2nd Coat - Interior Latex Topcoat
"S-W, ProMar 200 Zero VOC, Interior Latex, Flat"

I. 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"

J. 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.

SUBMITTAL CHECKLIST
1. Product Data.
2. Samples and Draw Downs.
3. Mock-Ups.
4. Compatibility Tests.

END OF SECTION 09900

SECTION 09950 - 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. Custom digital wallcovering on Type II vinyl wallcovering.

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.
   2. Submit actual samples of digital wallcovering substrate selected.
   3. Provide a 24”x 24” strike-off sample of custom digital wallcovering per wall for approval of quality and clarity of digital printing.

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., minimum for custom digital wallcovering:
   1. Commercial grade printable vinyl wallcovering media for modern wide format inkjet printers.
   2. Digital substrate pattern: Canvas, #DD04.

3. Backing: Poly-cotton woven.
4. ASTM-E84 Tunnel Test; Class A.
5. Conforms to CFFA Quality Standard for Vinyl wallcovering CFFA-W-101-D.
6. NFPA 286 Corner Burn Test; Class A.
7. NFPA 265 Corner Burn Test; Class A.
8. BS476 Parts 6&7: Passes all requirements.
9. CAN/ULC-S102.2: Passes all requirements.
10. ASTM-G21 Mold/Mildew: Passes all requirements.
11. Cadmium and lead free formulation.

C. Digital Images for custom digital wallcovering:
1. Architect and Owner to provide images to wallcovering manufacturer.
2. Include 2 hours of graphic design work by wallcovering manufacturer for design and composition of imagery.
3. Wallcovering manufacturer will provide final art for approval by Architect.

D. 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 09950

SECTION 10100 – 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. "Polyvision"
   3. "Aarco Products"
   4. "Platinum Visual Systems"
   5. "Marsh Industries, Inc."
   6. "CIG JAN Products"

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 (Frameless):
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.
6. All panels to be fully edge-wrapped with continuous fabric from face surface. Corners to be fully mitered or folded without splits or breaks between edges. Provide wrapped edge butt joints where panels abut one another.
7. Provide securing fasteners at each corner of all panels. Fasteners to be finished plated screws with flush-type receiving washer.

C. 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.

D. Mounting:
1. Provide on all types of visual display boards.
2. Wall attachment hardware, concealed from view, unless specifically indicated otherwise.

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.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Maintenance Instructions.
3. Samples.

END OF SECTION 10100

SECTION 10171 - SOLID PLASTIC TOILET PARTITIONS

PART 1 - GENERAL

1.01 WORK INCLUDED

Furnish labor, materials, equipment, special tools, supervision and services required to furnish and install all toilet partitions indicated, noted and detailed on the drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 05500 - Miscellaneous Metals
Section 10800 - Toilet Accessories

1.03 SUBMITTALS

A. Shop Drawings:
   1. Complete shop and erection drawings showing plan layout, all fabrication and erection details, anchorage, hardware and accessories.

B. 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.

C. Samples:
   1. Provide colors as specified on drawings.
   2. If color is not specified, submit samples of manufacturer's entire selection.
   3. Color charts alone may not be acceptable. Provide actual samples for selection upon request.

1.04 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver material in original unopened, undamaged packages.
   2. Identify by contents, color and room number.

B. Store materials in original protective packaging to prevent soiling, damage or wetting.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide materials manufactured by one of the following, or an approved equivalent.
   1. “Scranton Products” (Santana - Comtec - Capitol)
   2. "Accurate Partitions"
   3. "Ampco Products"
   4. "Global Partitions"
   5. "Rockville Partitions"
   6. “Metpar”
   7. “Sanymetal Partitions”
   8. “Bradley / Mills Partitions”
   9. "Columbia Partitions"
   10. “Hadrian”

B. See Specifications Section 01630 – Product Options and Substitutions.

C. If color and/or texture selection is indicated on Drawings, alternate manufacturer's must be able to provide an exact match to that specified in order to be deemed equivalent and acceptable.

2.02 MATERIALS

A. Doors, Partitions, Pilaster and Screens: High-density polyethylene (HDPE).

B. Hardware and Fittings:
1. Connection Brackets:
   a. 54” long, heavy-duty extruded aluminum.
   b. Bright anodized finish.
   c. Stainless steel screws.
2. Wall Brackets:
   a. 54” long, heavy-duty extruded aluminum.
   b. Bright anodized finish.
   c. Stainless steel screws.
3. Aluminum Door Hinges:
   a. ADA Stall: Continuous cam-action hinge and fabricated from heavy-duty (1/8” thick) extruded aluminum or stainless steel.
   b. Typical Stall: Standard swing-type concealed hinges, operable parts concealed in door.
   c. Through bolted with one-way sex bolts.
   d. Hinges: To remain open at approximately 15° when not in use.
4. Pilaster Shoes:
   a. 3” high, stainless steel.
5. Latches, Strike and Keeper:
   a. Heavy duty aluminum, brite finish.
   b. Provide pull on each side of door in each ADA stall or ambulatory stall.
   c. Emergency outside access feature on latch.
   d. Provide combination coat hooks and bumpers at each door interior face.
6. Headrail:
   a. Heavy-duty extruded aluminum.
   b. Bright anodized finish.
   c. Stainless steel screws.
   d. Anti-grip profile.
   e. Extruded profile to incorporate an integral track to accept a shower/privacy curtain and hooks. Where curtains are to be installed, provide quantity of hooks needed to provide equal and proper support of curtain in the arrangement and layout indicated.
7. Fasteners:
   a. Theft-resistant, finish to match hardware.
8. Heat Sync:
   a. Aluminum strip per manufacturer.
   b. Continuous on bottom of all doors and panels.
9. Coat Hook:
   a. Provide one hook on inside of each toilet partition stall door.
   b. Surface mounted, stainless steel, satin finish, with concealed mounting.
   c. Mount at ADA height at all ADA stalls.

2.03 FABRICATION

A. Design:
1. Floor Mounted, Overhead Braced.

B. Panels:
   1. Pre-pierce panels for fittings and hardware.
   2. Conceal reinforcement for hardware.

C. Thickness:
   1. 1 inch thick panels.
   2. 1/4 inch corner radius, all edges.

D. Size:
   1. Configuration and layout as indicated on the Drawings.
   2. Toilet partition panels to be 4'-7" height.
   3. Urinal screen panels to be 3'-6" height.
   4. Pilasters to be 6'-10" height.
   5. Locate all panels from finished floor as shown on the Drawings for the mounting heights desired.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Assemble using stainless steel screws.

B. Anchor to wall with connectors appropriate for substrate.

C. Set plumb and true to line and level, in a rigid substantial manner.

D. Conceal drilling, cutting and fitting in walls and ceiling.

E. Clearance at vertical edge of doors shall be uniform top to bottom and not exceed 3/16".

3.02 CLEANING

A. Upon completion, remove all materials, equipment and debris from the premises.

B. Wash thoroughly with cleaner recommended by manufacturer.

SUBMITTAL CHECK LIST

1. Shop Drawings.
2. Manufacturer's Literature.
3. Samples.

END OF SECTION 10171

SECTION 10190 - 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 RELATED WORK
Section 05500 - Miscellaneous Metals
Section 06100 - Rough Carpentry
Section 09215 - Veneer Plaster
Section 09510 - Acoustical Ceilings

1.03 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.

1.04 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 SHOWER CURTAINS
A. Basis of Specification:
“Salsbury Industries”, Staph Chek Linen Shower Curtains.

B. Description:
1. Inherently and permanently flame resistant meeting NFPA #701.
2. Include 20 inch high, flame retardant, white nylon 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 double needle seam with three layers of mesh over 1 inch poly reinforcement tape, 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.

C. Size:
1. Curtain bottom to be 1" above floor level. Curtain top to be at 2" maximum below track.
2. Fabric width to be the entire length of the track layout, plus 10%.

D. Color and pattern to be selected by Architect from manufacturer's entire selection.

2.03 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 10190

SECTION 10260 – 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:
"Koroseal Wall Protection Systems"; Korogard G200 Series Surface-Mounted Corner Guards.
"Pawling" Pro-tek NXT Impact Protection Systems, CG-10.
"C/S Acrovyn" Wall & Door Protection" SM-20N
"IPC Door and Wall Protection Systems"; 150 Surface Mount Corner Guard

a. Description:
1. Snap-on extruded vinyl corner guards with continuous aluminum retainer.
2. Dimensions: Leg length: 3", 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.

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 10260

SECTION 10350 - FLAGPOLE

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to furnish and install flagpole indicated, noted and detailed on the drawings and specified herein.

B. Includes LED light fixture accessory atop flagpole.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 03300 - Cast-In-Place Concrete

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data sheets, cutsheets, specifications, materials description, installation and maintenance instructions.

B. Shop Drawings:
   1. Indicate dimensions, finish, foundation drawings for the concrete foundation.
   2. All hardware and accessory items.

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.

1.04 DELIVERY, STORAGE AND HANDLING

A. Spiral wrap with heavy kraft paper of polyethylene.

B. Store and handle flagpoles to prevent damage and soiling.

PART 2 - PRODUCTS

2.01 FABRICATION

A. Pole:
   1. Aluminum, cone tapered.
   2. Ground set in concrete base.
   3. Exposed Height: 40'-0".
   4. Total length 44'-0".
   5. Butt Diameter: 8".
   6. Top Diameter: 3-1/2".
   7. Wall Thickness: .188".
   8. Factory-fitted self-aligning internal sleeve to facilitate field assembly without welding. Provide for a smooth exterior surface with tight visible joints without offsets.
   9. Finish: clear anodized, AA-C22-A41, Class 1.

B. Ball:
   1. 14 gauge aluminum.
   2. 8" diameter.
   3. Mount on 5/8" diameter rod attached to truck.
   4. Finish: clear anodized.

C. Truck:
1. Cast aluminum.
2. Manufacturer's standard ball-bearing non-fouling.
3. Double revolving assembly with aluminum pulley.

D. Halyards:
1. Single halyard internal.
2. 5/16" diameter.
3. #10 waterproof braided polypropylene rope, white.
4. Two (2) chrome-plated bronze swivel snaps for securing to each flag.

E. Cleats:
1. One (1) 9" cast aluminum cleats per halyard, finish to match pole.
2. Attached to pole with two 5/16" flat head stainless steel machine screws.

F. Foundation Tube:
1. 16 gauge hot dipped galvanized corrugated steel with corrugations horizontal.
2. Inside diameter: 12".
3. Length: 4'-0".

G. Base:
1. Base plate: 16" x 16" x 1/2" steel plate.
2. Plate support shall be 6" x 6" x 1/2" steel plate.
3. Ground spike: 3/4" diameter steel lightning rod, 24" long, all weld construction.

H. Accessories:
1. Flash collar, F214 cast aluminum type FC-11.
2. Steel wedges.
3. Hardwood wedges.
4. Miscellaneous items as required.

I. Flags:
1. U.S. Flag: 8' x 12'.
2. Indiana Flag: 6' x 10'.
3. Polyester ("Tufftex") material.
4. Provide flags indicated per pole.

J. Light Fixture:
1. Equal to: “American Flagpole” #DL-CHFLKTDLED-20W.
2. Double LED flagpole downlight and truck combination unit, 360 degree with adjustable aiming.
3. Pole to have internal cam-cleat capable of receiving light fixture accessory.
4. Provide wiring internal to pole from below ground at base to light fixture accessory atop pole.
5. Provide ball atop light fixture accessory.
6. Finish: clear anodized.

PART 3 - EXECUTION

3.01 PREPARATION

A. Paint unexposed section of pole below ground, inside and outside, with heavy coat of black asphaltum paint, before shipment.

B. Concrete foundation for flagpole will be constructed based on the flagpole manufacturer's approved shop drawings.

3.02 INSTALLATION

A. Erect flagpole plumb, fixed firmly in its base at setting depth indicated in compliance with accepted shop drawings and manufacturer's instructions.

B. Provide positive lightning ground for the flagpole installation.

C. Install wiring internal to pole from below ground at base to light fixture accessory atop pole.

SUBMITTAL CHECK LIST

1. Product Data.
2. Shop Drawings.
3. Samples.

END OF SECTION 10350

SECTION 10420 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 – Rough Carpentry

1.03 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 10420

SECTION 10430 - EXTERIOR SIGNS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Exterior signage as indicated on the Drawings and specified herein, including:
   1. Pre-finished metal lettering.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 10440 - Interior Signs

1.03 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 actual samples of colors as specified. Color charts alone are not acceptable.
   2. If not specified, submit samples of manufacturer's entire selection.
   3. Submit additional actual color samples as requested for selection of verification.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver and store letters in manufacturer's protective packaging.
B. Handle letters so as to prevent damage to finish.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cut Metal Lettering:
   1. Basis of Specification: "ASI Sign Systems", LPS Series.
   2. Material: Aluminum, 3003 H14 alloy.
   3. Thickness: 1/4", sawn.
   4. Text: As indicated on Drawings.
   5. Size: As indicated on Drawings.
   6. Font: As indicated on Drawings, or as selected from all manufacturer's standard fonts. Custom made fonts or typestyle may be required if indicated.
   7. Finish: Clear anodized or baked enamel finish as indicated on Sign Schedule. If not indicated, color and finish to be selected from manufacturer's entire standard color range.
   8. Mounting: Spacers for 1/2" stand-off.
   9. Fasteners: Manufacturer's standard concealed anchoring device for wall type.
   10. Setting Cement: As recommended by manufacturer.

2.02 SIGN SCHEDULE

A. Material: Cut Metal Lettering
Text: Clarksville Fire Department
Location: Mount on exterior wall. See exterior elevations for further information.
Size: 12” upper and lower case.
Font: To be Selected.
Finish: Baked Enamel.

B. Material: Cut Metal Lettering
Text: Clarksville
Location: Mount on exterior monument sign. See Civil Drawings for further information.
Size: 12” upper and lower case.
Font: To be Selected.
Finish: Baked Enamel.

C. Material: Cut Metal Lettering
Text: Station
Location: Mount on exterior monument sign. See Civil Drawings for further information.
Size: 4” upper and lower case.
Font: To be Selected.
Finish: Baked Enamel.

D. Material: Cut Metal Lettering
Text: 1
Location: Mount on exterior monument sign. See Civil Drawings for further information.
Size: 1’-4” high.
Font: To be Selected.
Finish: Baked Enamel.

E. Material: Cut Metal Lettering
Text: 1
Location: Mount on exterior wall. See exterior elevations for further information.
Size: 12” high.
Font: To be Selected.
Finish: Baked Enamel.

F. Material: Cut Metal Lettering
Text: 2
Location: Mount on exterior wall. See exterior elevations for further information.
Size: 12” high.
Font: To be Selected.
Finish: Baked Enamel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Masonry Wall:
1. Drill 3/16" x 1-1/2" deep holes directly in masonry wall.
2. Set pins in grout.
3. Mount letters projected from masonry. Use spacing collars.

B. Stud Wall or Furred Channels:
   1. Drill and tap directly into studs whenever possible.
   2. Anchors and pins to be by manufacturer of self-securing type for use in a hollow wall condition. Provide as required to properly secure signage in place.
   3. Mount letters projected from wall. Use spacing collars.

SUBMITTAL CHECK LIST

1. Manufacturer's Literature.
2. Signage Layout.
3. Mounting Template.
4. Samples.

END OF SECTION 10430

SECTION 10440 - 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.

1.02 RELATED WORK SPECIFIED ELSEWHERE
- A. Section 10430 - Exterior Signs

1.03 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.
  3. Submit a CAD generated location plan noting the location of all signage and cross reference to message schedule or plots for architect’s approval.

- 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.

1.04 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; 1-1/2" numerals shall be used for all room numbers.
7. Font: As selected from manufacturer's entire standard selection.
8. Square corners.
9. Size: As shown on Drawings. See A-901

2.02 COORDINATION

A. Colors shall be selected from manufacturer's entire standard selection, panel and type.

B. Room 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.

2.03 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 janitorial and custodial rooms shall be identified by "Custodial", unless otherwise indicated.
3. All mechanical and utility rooms shall be identified by "Mechanical", unless otherwise indicated.
4. All electrical rooms shall be identified by "Electrical", unless otherwise indicated.
5. All fire extinguishers shall be identified by universal symbol for extinguisher.
6. Typical sign elevations may be indicated on Drawings. See miscellaneous details on Drawings.

2.04 SIGN SCHEDULE (ROOM IDENTIFICATION SIGNS)

A. Sign Type: "A"
Location:
Meeting Room 101
Office 102
Watch Room 104
Bedroom 1: 105
Bedroom 2: 106
Bedroom 3: 107
Bedroom 4: 108
Fitness Room 109
Day Room 110
Pantry 112
Custodial 113
Shower 116
Shower 117
Mechanical 121
Decon. 123 (Qty 2)
Laundry 124 (Qty 2)
IT 126
Gear Room 127 (Qty 2)
Records Room 129
Fire Marshall 132

Hose Storage 135
Tool Room 136
Evidence 138
Electrical/Storage 139
Apparatus 133 (Door to Corridor 125)
Text: To be selected by Architect

Sign Type: “B”
Location: Adjacent to Restroom 128
Text: As shown on Elevations

Sign Type: “C”
Location: Adjacent to Women’s Restroom 115
Text: As shown on Elevations

Sign Type: “D”
Location: Adjacent to Men’s Restroom 118
Text: As shown on Elevations

Sign Type: “E”
Location: Adjacent to Fire Extinguisher at Corridor 122, Kitchen 111, Corridor 114, Mechanical 121, Apparatus Room 133
Text: As shown on Elevations

Sign Type: “F”
Location: Adjacent to Exit at Vestibule 131, Kitchen 111, Corridor 114, Apparatus 133 (Qty:2)
Text: As shown on Elevations

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.
5. CAD Location Plan.

END OF SECTION 10440

SECTION 10503 – TURNOUT GEAR WALL-MOUNTED LOCKERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Design, fabrication and installation of wall mounted turnout gear lockers as specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 - Rough Carpentry.

1.03 SUBMITTALS

A. Shop Drawings:
   1. Indicate sizes, dimensions, gauges, construction, trim, finish and hardware.
   2. Manufacturer’s product data and installation instructions.

B. Samples:
   1. Where colors are specified as "to be selected", submit samples showing manufacturer's full range of standard colors for each type.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store and handle materials to avoid damage and exposure to elements. Remove damaged otherwise unsuitable material from job site.

1.05 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 TURNOUT GEAR WALL MOUNTED LOCKERS

A. Provide products by one of the following approved products:
   1. “Mid-Minnesota Wire” GearGrid Wall Mounted Storage System
      a. www.geargrid.com

B. Type and Size:
   1. Standard 20” opening: Overall dimension- 74-1/2” high x 20” wide x 20” deep
   2. Clear Opening: 18.75”

C. Vertical Dividers:
   1. Outer Frame:
      a. 1.25” O.D. x 16 gauge steel tubing.
   2. Back and Inner Grid:
      a. .25” diameter ASTM 510 cold drawn steel wire resistance welded to a 3” square pattern.

D. Accessories:
   1. Shelves
      a. Provide one steel wire shelf at top and bottom of locker.
      b. Steel bracket for name placard.
   2. Apparel Hooks:
      a. Provide three per opening.
   3. Name plate.
      a. 20 gauge sheet metal

b. Accepts 2” x 16” custom printed name plate.

E. Finish:
1. Powder Coat Finish.
2. Color as selected from manufacturer's entire selection.

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, mounting brackets and other fasteners as required for complete installation.

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 10503

SECTION 10522 - 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. Dry Chemical Type:
a. Basis of Specification: "JL Industries, Inc." Cosmic 10E.
b. Fire Class: ABC.
c. U.L. Rating: 4A-80BC.
d. Capacity: 10 pounds.
2. 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 Dry Chemical 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 1-1/2” 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. 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.
3. Provide fire rated cabinets at all Rated Walls and Smoke Partitions.

C. Fire Extinguisher Brackets:
   1. Manufacturer's standard wall mounted type for each specific extinguisher type.
   2. Provide to secure top and bottom of extinguisher.

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 10522

SECTION 10800 - 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 RELATED WORK SPECIFIED ELSEWHERE

Section 10171 - Solid Plastic Toilet Partitions

1.03 SUBMITTALS

A. Manufacturer's Literature:
   1. Submit manufacturer's "cut sheets" for each item specified, showing installation details, and product information.

1.04 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 01630 - 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. 24" long horizontally on end walls of showers.
      b. 36" long horizontally on rear wall of all ADA stalls.
      c. 42" long horizontally on side wall of all ADA stalls and ambulatory stalls.
      d. 48" long horizontally on side walls of showers.
      e. 18" long vertically on side wall of all ADA stalls and ambulatory 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".

D. Mirrors (Full Length):
   1. “Bradley” 747-2460 Series.
   2. 1/4” select float glass frameless mirror.
   3. Edges ground and polished smooth.
   4. Surface mounted, concealed fasteners.
   5. Provide sizes as shown on Drawings.
   6. Provide at locations as shown on Drawings.

E. 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.
   5. Provide two at each shower stall.
   6. Mount one hook at ADA height at all ADA shower stalls.

F. Soap Dish:
   1. “Bobrick” B-6807.
   2. Surface-mounted, stainless steel, satin finish.
   3. Provide at locations as shown on Drawings, or if not shown, provide one at each shower.
   4. Coordinate location with shower controls and other accessories.

G. Shower Seat:
   1. “Bobrick” B-517 (right hand) / B-518 (left hand).
   2. Surface-mounted.
   3. 1-1/2” thick with enclosed 1/2” plywood base.
   4. Foam-padded water-resistant naugahyde seat.
   5. Stainless steel frame and mounting brackets.
   6. Provide at locations as shown on Drawings, or if not shown, provide one at each shower.

H. Mop Racks:
   1. “Bobrick” B-223.
   2. Surface-mounted, stainless steel, satin finish.
   3. Provide at locations as shown on Drawings, or if not shown, provide one per every mop sink and service sink.

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 10800

SECTION 12325 – 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. Plastic Laminate countertops as indicated on the Drawings atop plastic laminate casework.
F. Quartz countertops as indicated on Drawings atop plastic laminate casework.
G. Custom plastic laminate built-in bench as indicated on the Equipment Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 06100 – Rough Carpentry
Section 06400 – Architectural Woodwork
Division 15: Plumbing and Mechanical components, connections, taps, disposals, coordination.
Division 16: Electrical components, connections, and coordination.

1.03 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.

1.04 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.

1.05 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.

1.06 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.

1.07 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.

1.08 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. "Formica"
   b. "Wilsonart"
   c. "Nevamar"
   d. "Pionite"
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.
6. Chemical resistant type finish protection where specified, to equal or exceed the following:
   a. "Wilsonart", "Chemsurf".
   b. "Formica", "Chemtop".

F. Quartz Material:
1. Acceptable Manufacturers and Products:
   a. "Zodiaq" by "Dupont".
   b. "Silestone" by "Cosentino".
   c. "Cambria".
   d. "Caesarstone International".
   e. "Daltile".
2. 1-1/8" thick for countertops.
3. 3/4" thick for backsplashes and end splashes, 4" high unless otherwise noted.
4. Edge Profile: Basic Eased.

G. 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.

H. 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.

I. 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.

J. 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.

K. 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. “Amerock” Allison Value; 3-3/4” CTC pull, BP53003FB.
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. Finish: Flat Black
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 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.

G. 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.

H. Silencers:
1. Cork, plastic, or rubber type silencers.
2. Provide on all drawers and doors.

I. 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.

2.03 FABRICATION

A. Base:
1. Continuous under all base and storage cabinets.
2. Rubber base furnished and installed per Section 09650.

B. Countertops:
1. 1” thick, plastic laminate faced, with PVC covered edge.
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 12325

SECTION 12502 - 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. Single-Roller Window Shades, with a screen fabric shade.
   2. Dual-Roller Window Shades, with a screen fabric shade and an interior blackout fabric shade.

1.02 SUBMITTALS

A. Window Shades Schedule:
   1. Indicate locations, 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 SINGLE 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, vertical roll-up, fabric window shade with bead chain and clutch operating mechanism.

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.

F. Color:
1. As indicated on the Drawings, or if not indicated, to be selected by Architect from manufacturer's entire selection.

2.03 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. Room Darkening Side and Sill Channels:
1. Rear, interior blackout shade only.
2. 2-chambers; one for fabric and fabric retainer, and the other for fabric guide/channel locator.
3. Extruded aluminum with polybond edge seals and SnapLoc-mounting brackets and with concealed fastening. Exposed fasting is not acceptable. Channels shall accept one-piece exposed blackout hembar with vinyl seal to assure side light control and sill light control.

E. 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.

F. Fascia:
1. L-shaped aluminum extrusion to conceal shade roller and hardware.
2. Finish: Baked enamel.

G. Color:
1. As indicated on the Drawings, or if not indicated, to be selected by Architect from manufacturer's entire selection.

2.04 SCREEN FABRIC

A. Basis of Specification: “Sheerweave 2000”

B. Description:
1. Interior sun control, 37% vinyl on fiberglass, 63% PVC in full basketweave.

C. Attributes:
1. Weight: 14.26 ounces per square yard
2. Thickness: .019 inches
3. Roll Width: 63”, 98” or 126 inches
4. Openness: 5 percent
5. Color: Charcoal/Gray
6. Class A Fire Rating
7. Bacteria and fungal resistant.

2.05 INTERIOR BLACKOUT FABRIC

A. Basis of Specification: "Avila Twilight” Blackout AT-0101

B. Description:
1. Interior sun control, 100% polyester with acrylic foam blackout coating.

C. Attributes:
1. Weight: 14.5 ounces per square yard
2. Thickness: .020 inches
3. Roll Width: 118 inches
4. Openness: 0 percent
5. Class A Fire Rating
6. Bacteria and fungal resistant.

D. Color:
1. Interior and Exterior: Pewter.

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 12502

SECTION 12560 - PULL DOWN WALL BEDS

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 pull down wall beds 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. Plans, elevations, sections, details and equipment list.
   2. Indicate construction of units, field verified dimensions and all construction detailing required to coordinate with installation requirements.
   3. Identify units by designation as indicated on the Drawings for proper coordination.

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, STORAGE AND HANDLING

A. Deliver materials in manufacturer's original, unopened, containers.

B. All units to be labeled as identified on Drawings so as to allow easy identification and correct location.

1.04 QUALIFICATIONS

A. Manufacturer and Supplier's Qualifications:
   1. Manufacturer shall be a professional company whose regular practice involves the construction of pre-manufactured, commercial quality wall bed units, and is ISO 9000 certified for manufacturing.
   2. Manufacturer shall have been in business producing wall beds for a period of 5 years minimum.
   3. Manufacturer shall be able to demonstrate having produced such wall beds of a like size and scope for a minimum of ten (10) previous project locations.
   4. Manufacturers and Suppliers wishing to be have products included for bidding shall submit qualifications in writing to the Architect no later than ten (10) days prior to the bid.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following approved manufacturers:
   1. "SICO America, Inc."

2.02 BED MECHANISM

A. Description:
   1. Frame constructed of 16 gauge minimum steel tubing, fully welded construction.
   2. Designed to permit beds to be folded and unfolded into use position with a minimum of effort.
   3. When bed is in the use position, bed shall come completely out of the wall recess and remain

flush with the face of cabinets, to eliminate the user from sleeping within the recessed area.
4. Provided with a slanted, padded headboard, vinyl covered, to hold pillows in place when the bed is folded for storage, and eliminate pillows falling off bed recess during use.
5. Padboard constructed of vinyl covering over 1/2 inch foam over 1/2 inch A/C plywood.
6. Headboard constructed of vinyl covering over 3/4 inch particle board.

B. Hardware:
1. Hinges shall be 1/8 inch or heavier steel, fully welded.
2. Manufacturer's standard baseplate for secure and proper installation as directed by the manufacturer.
3. Provide all necessary hardware for complete anchoring to wall and floor surfaces as directed by the manufacturer.
4. All hardware shall operate independent of surrounding cabinet work.

C. Finish:
1. Factory finished, electrostatic paint with baked-on powder coat finish.
2. Colors for powder coated materials shall be as indicated on the Drawings, or if not indicated, to be selected by Architect from manufacturer's entire selection.
3. Plastic laminates for the finish face of bed, when folded, shall be as indicated on the Drawings, or if not indicated, selected by Architect from manufacturer's entire selection from all price groups and options available.
4. Colors for vinyl materials shall be as indicated on the Drawings, or if not indicated, to be selected by Architect from manufacturer's entire selection.

2.03 BOX SPRING AND MATTRESS

A. Description:
1. One set per bed unit.
2. Sets shall be of commercial design and quality.
3. Coil spring construction and bed, when assembled with box spring and mattress, shall rest at a bed height between 18 inches and 20 inches from the floor.
4. Box spring shall be vinyl wrapped on all edges to eliminate soiling in use and allow easy cleaning.
5. Box spring shall be securely fastened to the bed frame with screws and L-clips as directed by the manufacturer.
6. Mattress shall be provided with mattress strap and velcro to attach mattress to box spring and frame.
7. Coils to be #5160 steel.

B. Color:
1. Colors shall be as indicated on the Drawings, or if not indicated, to be selected by Architect from manufacturer's entire selection.

2.04 SIZE

A. Provide sizes as follows:
1. Twin Regular Length, Twin Extra-Long, Double Regular Length, Double Extra Long, Queen, King, California King.
2. Sizes may vary, as indicated on Drawings.
3. If not indicated, provide as Twin Regular Length.

2.05 CABINETRY

A. Description:
1. Pre-manufactured, commercial grade, quality design, construction and workmanship.

2. Verticals shall be high quality 1-1/8 thick particle board core to eliminate warpage.
3. All surfaces to be laminated with high pressure plastic laminate.
4. All edges to be manufacturer's standard PVC strip edging.

B. Closet Units:
1. Shall be high quality 5/8 inch thick particle board core.
2. To be nominally 16 inches wide and 22 inches deep.
3. All surfaces to be laminated with high pressure plastic laminate.
4. All edges to be manufacturer's standard PVC strip edging.
5. Closet style as indicated on Drawings, or if not indicated, selected by Architect from manufacturer's entire selection of standard units available.
6. If no closet is indicated, provide standard vertical panel at each side of bed unit opening.

C. Header:
1. Provide one with each unit.
2. To span entire opening of bed unit.

D. Finish:
1. Plastic laminates shall be as indicated on the Drawings, or if not indicated, selected by Architect from manufacturer's entire selection from all price groups and options available.

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 units level and plumb, allow clearance for proper operation, and demonstrate units to be in uniform and smooth working order.

B. Provide clearance of all items and components to permit unencumbered operation.

C. 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 all dirt, oils and soiled materials.

B. Leave work area clean and free of debris.

SUBMITTAL CHECK LIST
1. Product Data.
2. Shop Drawings.
3. Samples.

END OF SECTION 12560

SECTION 13850 - FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This specification describes a fire detection and alarm system. The control panel, to be intelligent device addressable, analog detecting, low voltage and modular, with digital communication techniques, in full compliance with all applicable codes and standards.

B. The Contractor shall furnish a complete system that meets or exceeds the minimum requirements, features and capacities as indicated on the Drawings and specified herein.

C. The system shall be in full compliance with National and Local Codes and requirements.

D. The system shall include all required hardware, piping, raceways, interconnecting wiring and software to accomplish the requirements of this specification and the contract drawings, whether or not specifically indicated.

E. All equipment furnished shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of analog fire detection devices for over ten years.

F. The system as specified shall be supplied, installed, tested and approved by the local Authority Having Jurisdiction, and turned over to the Owner in a functional and operational condition.

G. In the interest of job coordination and responsibilities, the Contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing a “UL Listing Certificate” for the complete system.

H. Furnish all labor, materials, equipment, special tools, supervision and services required.

I. All products supplied shall be non-proprietary. Any items that are supplied or installed that are proprietary to a specific system shall be removed and replaced with non-proprietary materials at no additional costs to the Owner.

1.02 DESCRIPTION OF SYSTEM

A. System shall be fully addressable.

B. This section includes providing a complete and operative fire alarm system in the project as indicated on the drawings, specified herein and elsewhere required.

C. System shall consist of control panel, remote annunciator panel, manual stations, fire alarm signals, automatic smoke and heat detectors, fan shutdown relays, conduits, boxes, wire, etc. All electrical work shall conform to applicable sections of these specifications except where specified otherwise.

D. System shall be actuated by any automatic or manual initiating device, or the kitchen hood system, which shall immediately sound all alarm devices continuously until actuating device is restored to normal and control panel is reset. System shall automatically shut down all air supply and exhaust fans and automatically restart this equipment when the system is returned to normal. Operation of any alarm initiating device shall be indicated on its associated alarm zone and any trouble with the wiring or device shall be indicated as its associated trouble zone.

E. System shall include an automatic dialer to send a fire alarm signal to an approved alarm receiving facility who shall notify the designated parties of the alarm condition.

F. System shall be designed for direct-current (DC) and shall be supplied with standby battery supply and automatic battery charging system. System shall be designed for connection to a 120 volt dedicated (AC) circuit.

1.03 APPROVALS

A. The publications listed below form a part of this publication to the extent referenced. The publications are referenced in the text by the basic destination only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted and earlier version.
   1. National Fire Protection Association (NFPA)
      a. Maintenance of Sprinkler Systems.
      b. NFPA 70 National Electrical Code.
      c. NFPA 72,Standard for Installation, Maintenance and use of protective signaling systems.
   2. American with Disabilities Act.
   3. Underwriters' Laboratories, Inc. (UL)
      a. UL FPED
      b. A.D.A. Federal Guidelines
   4. State and local building codes as adopted by the Authority having jurisdiction.

1.04 QUALIFICATION OF INSTALLER

A. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the same scope, type and design as specified. The contractor shall include the names and locations of at least two installations where the manufacturer has installed such systems.
   1. The Contractor shall submit copies of all required licenses and bond as required in the state having jurisdiction.
   2. The installing contractor shall employ on staff a minimum of one NICET level 3 technician or a professional engineer, registered in the State of the project location.

1.05 QUALIFICATION OF MANUFACTURER

A. Provide the services of a factory trained and certified representative or technician, experienced in the installation and operation of the type of system provided. The representative shall be licensed in the State if required by law. The technician shall supervise installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The technician shall provide the required instruction to the owner's personnel in the system operation and maintenance.

B. Contractor shall maintain a factory trained service department with service personnel available on a 24 hour, 7-day per week basis. Provide a 24-hour emergency service number with a maximum telephone response time of 1 hour.

C. Contractor shall maintain a spare parts inventory of critical function components.

D. Contractor’s personnel shall have a minimum of 2 year’s experience in service and maintenance of fire detection, and alarm systems.

1.06 SUBMITTALS

A. The Contractor shall include, at a minimum, the following information:
   1. Power calculations. Battery capacity calculations. Battery size shall be minimum of 125% of the calculated requirement.
   2. Supervisory power requirements for all equipment.

3. Alarm power requirements for all equipment.
4. Power supply rating justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25% spare capacity.
5. Voltage drop calculations for wiring runs demonstrating worst-case condition.
6. Complete manufacturers catalog data including supervisory power usage, alarm power usage, physical dimensions, and finish and mounting requirements.
7. Complete drawings covering the following shall be submitted by the contractor for the proposed system:
   a) The submittals shall include drawings (in CAD compatible format) showing a schematic arrangement of the system including the main control unit and all peripherals The drawing shall show the type, quantity and arrangement of all modular components within the control unit and shall indicate overall cabinet dimensions. The drawings shall show explicit details regarding the positioning and placement of all detection system components. The drawing shall also include building floor plans drawn to a minimum scale of 1/8” = 1’-0”.
   b) Floor plans shall show all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electric Code fill used.
   c) Provide a fire alarm system function matrix as referenced by NFPA 72. Matrix shall illustrate alarm input/out events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at time of bid.
8. Installation drawings shop drawings, and as-built drawings shall be prepared by an individual who is experienced with the work specified herein.
9. Incomplete submittals shall be returned without review, unless with prior approval of the Engineer.

1.07 INSTALLATION SUPERVISION

A. Supervision:
Shall include services of factory trained technicians to supervise installation of systems during construction, to assist in the system start-up and to inspect systems during guarantee period. Make a complete inspection at the end of the guarantee period, and forward signed statement of inspection after all corrections and maintenance items have been completed, to Architect/Engineer. This report will be filed with the project records.

B. Testing:
Submit on completed of work, verification of a point-by-point check test indicating the date and time of each item inspected. Issue a certificate conforming that the inspection has been completed and the system is installed and functioning in accordance with the specifications. This report will be filed with project records and in the bound "Maintenance and Operations Manual".

1.08 SERVICE GUARANTEE

A. Submit satisfactory evidence that there is a fully equipped, local service organization within Seventy-Five (75) miles of the project that is capable of rendering adequate inspection and service to equipment within three (3) hours after notification including standard part replacement. This organization shall be an authorized dealer for the equipment furnished on this project and prepared to offer service contract for maintenance of equipment after guarantee period.

1.09 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Give complete oral and printed instructions to operating personnel, who will verify to Architect/Engineer that they are fully aware of operation and maintenance of equipment.

B. Furnish bound copies of "Operation and Maintenance Manual".

C. Include operation instructions, wiring and schematic diagrams of equipment, one-line diagram of system, complete servicing data, part numbers and voltage charts, and internal wiring diagrams of component equipment.

D. The fire alarm system contractor or manufacturer shall offer for the owner's consideration and evaluation at the time of system submittal, a priced inspection, maintenance, testing and repair contract in full compliance with the requirements of NFPA 72H.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide a complete system by one of the following manufacturers, or an approved equivalent:
1. "Siemens"
2. "Tyco/Simplex Grinnell"
3. "Edwards/GE Security"
4. "Notifier"

2.02 FIRE ALARM CONTROL PANEL (FACP)

A. Equal to: "Tyco/Simplex Grinnell" #4008-9121.

B. Control unit shall be semi-recessed in the wall, modular design, dead front construction using solid state electronic components. Alarm initiating shall meet all requirements of NFPA 72A for limited energy applications and function with up to 1500 ohms resistance through alarm initiating devices, contacts and associated wiring. Control panel with annunciator shall be recessed, flush with the finished wall. Enclosing cabinet shall be red in color.

C. Auto Dialer shall be digital type, dual-telephone line capability, capable of monitoring and reporting up to eight supervised circuits. Unit shall include battery, transformers, enclosure, etc., for a complete functional unit.

D. Include LCD annunciated circuit-specific character custom labels with LED indicator points visible in front face of cabinet.

E. Control panel shall contain internal trouble signals with silencing switches, system reset switch, system test switch and shall be supervised so that trouble signal shall indicate in event of loss of either operating or standby power.

F. Annunciators shall be provided in face of control unit and shall indicate when both operating and standby power circuits are energized.

G. Trouble signal silencing switches shall be provided one each zone with associated pilot lights so that faults initiating and alarm circuits can indicate trouble and be silenced independently. Trouble signals shall automatically restore to normal condition. Separate pilot lights shall be provided for each signal circuit. Relays used for sounding alarm and trouble signals shall have coils electrically supervised and sound trouble signal in event of open coil.

H. Alarm Verification:
System shall include alarm verification for all smoke detectors, that is after a 30 second delay the system automatically resets itself and only sounds an alarm if the same detector initiates an alarm with 60 seconds. This feature shall have no effect on other initiating devices including other smoke detectors.

I. Control panel shall be furnished with minimum point capacity of 200 initiating devices. Initiating devices shall be any combination of smokes, pull stations, heat detectors, duct detectors, control modules or monitor modules.

J. Maintenance Alert:
Control panel shall continuously monitor the sensitivity of each smoke and heat detector and be capable of reporting maintenance conditions when dirty, dusty, faulty or in need of attention.
Control panel shall make notification via remote dialer.

K. All pilot and indicating lamps shall be light-emitting diodes (LED) or (LCD) for long life.

L. Control panel shall be fully addressable.

2.03 FIRE ALARM ANNUNCIATOR PANEL (FAAP)

A. Equal to: "Tyco/Simplex Grinnell" #4603-9111.

B. Annunciator shall be remote from the control panel in location as directed by the Architect.
Annunciators shall be LCD remote annunciator with the same control functions as the main control panel operator interface. Trim shall be either stainless steel or aluminum, brushed, clear finish.

C. All pilot and indicating lamps shall be light-emitting diodes (LED) or (LCD) for long life.

D. Zone alarm signal shall be illuminated whenever associated alarm initiating device is activated and zone trouble signal shall be illuminated whenever associated zone circuit is open or shorted out.

E. Test switch test all circuit components including lamps.

F. Reset Switch:
Shall be necessary to restore alarm initiating device to normal and manually activate system reset switch to extinguish annunciator alarm signal.

G. Silencing of a trouble signal when fault occurs on any alarm zones shall not prevent resounding of trouble signal in event of subsequent fault condition of other zones, alarm signal circuits, or loss of either source of power.

H. Wiring Supervision:
All field wiring connected to alarm initiating devices shall be electrically supervised and single opening or ground shall not cause illumination of any alarm signal.

2.04 STANDBY BATTERY AND CHARGER

A. Standby battery and charger shall be incorporated in Control Panel and shall be furnished to sound alarms in the event of loss of normal power. Batteries shall have sufficient capacity to sound alarms for five (5) minutes after 24 hour power interruption.

B. Charger shall use solid-state circuitry and shall be capable of recharging battery fully within 12 hours. Under normal charging, charger shall charge battery at high rate and automatically switch to low maintenance rate charge when battery is fully charged. Charger shall contain both voltmeter and ammeter of 5% accuracy.

C. Pilot light shall be provided and remain on to indicate 120 volt AC power source. In event of loss of 120 volt AC power, a trouble signal shall sound. An amber signal indicator shall be used to show that trouble signal has been silenced.

D. Battery charger circuit shall be current limited to prevent damage in event of a short circuit on battery leads.

2.05 MANUAL ALARM STATIONS

A. Equal to: "Tyco/Simplex Grinnell" #4099-9001.

B. Manual Alarm Boxes shall be single acting, non-coded, semi-flush mounted, break rod feature, mechanically latched when actuated, and key reset to normal position. Rod shall not be required to maintain normal position. Construction shall be molded modern design, red finish, with instructions in raised white letters.

C. Provide twenty-five (25) spare glass rods at control panel location.

2.06 VISUAL ALARM DEVICES

A. Equal to:
1. "Tyco/Simplex Grinnell" True Alert #4906-9204 (Ceiling Type)
2. "Tyco/Simplex Grinnell" True Alert #4906-9201 (Wall Type)

B. Description:
1. Shall be furnished per the drawings.
2. Multi-candela strobe.
3. Ceiling-mounted or wall-mounted unit as and where indicated.
4. Housing color White, “Fire” lettering Red (Ceiling Type).
Housing color Red, “Fire” lettering White (Wall Type).
5. Provide candela ratings in compliance with the Code, ADAAG and NFPA 72, 2002.
6. Xenon strobe with a minimum repetition rate of 1 HZ, not exceeding 3 HZ and a maximum duty cycle of 40% with a pulse duration of .2 seconds.
7. Unfiltered or clear filtered white light.
8. Devices shall be synchronized in each line of sight per ADA.

C. Installation and Requirements:
1. Devices shall be mounted at a height of 80 inches above the highest level of the finish floor or 6 inches below the ceiling, whichever is lower.
2. Devices shall be located no further than 15'-0" from the end of any corridor.
3. Installation heights and locations shall comply with the ADA.

2.07 AUDIBLE/VISIBLE ALARM DEVICES

A. Equal to:
1. "Tyco/Simplex Grinnell" True Alert #4906-9230 (Ceiling Type)
2. "Tyco/Simplex Grinnell" True Alert #4906-9227 (Wall Type)

B. Description:
1. Shall be furnished per the drawings.
2. Horn with multi-candela strobe.
3. Ceiling-mounted or wall-mounted unit as and where indicated.
4. Housing color White, “Fire” lettering Red (Ceiling Type).
Housing color Red, “Fire” lettering White (Wall Type).
5. Provide candela ratings in compliance with the Code, ADAAG and NFPA 72, 2002.
6. Xenon strobe with a minimum repetition rate of 1 HZ, not exceeding 3 HZ and a maximum duty cycle of 40% with a pulse duration of .2 seconds.
7. Unfiltered or clear filtered white light.

8. Devices shall be synchronized in each line of sight per ADA.
9. Provide a minimum of 15 db above ambient sound levels.

C. Installation and Requirements:
1. Devices shall be mounted at a height of 80 inches above the highest level of the finish floor or 6 inches below the ceiling, whichever is lower.
2. Devices shall be located no further than 15'-0" from the end of any corridor.
3. Installation heights and locations shall comply with the ADA.

2.08 SMOKE DETECTORS

A. Smoke detectors shall be photo-electric type completely solid state with light emitting diode and shall not use any ware filament vacuum tubes.

B. Duct type smoke detectors shall be provided in all air handling units above 2,000 CFM in the return side and both on the return and supply side in units above 15,000 CFM. Duct type detectors shall be provided with remote indicating pilot lights and test switches, mounted 4'-0" above the floor. Verify exact location with Architect/Engineer.

C. Ceiling type smoke detectors shall be combination heat and smoke sensing type, provided with indicating pilot light and test switches.

D. Smoke Detectors which operate electromagnetic door holders, air handling units, roll-down screens, etc. shall be provided with two sets of contacts. One set shall release the door or screen, shut down the air handling unit; the other set shall sound a general fire alarm.

E. Provide one smoke detector on each side of every door held by electromagnetic door holders, wherever holders are indicated. Provide smoke detectors whether or not they are indicated on the Drawings.

F. Provide one smoke detector on each side of every smoke damper, wherever smoke dampers are indicated. Provide smoke detectors whether or not they are indicated on the Drawings.

G. Smoke detectors indicated with audible base shall have capability of two distinct alarm conditions. Upon activation of the smoke detector chamber a supervisory signal shall be annunciated at the fire alarm panel. Upon thermistor and smoke detector activation a general alarm condition shall be sounded.

H. Smoke detector audible bases shall contain a mini horn capable of 85 dB at 10 feet.

2.09 HEAT DETECTORS

A. Heat detectors shall be ceiling mounted employing two independent methods of detection.

B. All units shall be combination units detecting a fixed temperature rating of 135 degrees F (57 degrees C) and a rate-of-rise of 15 degrees F (8.3 degrees C) per minute spaced a maximum of 50 ft. on center.

C. Fixed temperature units shall detect a fixed temperature rating of 190 degrees F (88 degrees C) spaced a maximum of 15 ft on center. Install in mechanical rooms, kitchens and cooking spaces.

2.10 ELECTROMAGNETIC DOOR HOLDERS

A. Equal to:
1. "Tyco/Simplex Grinnell" #2088-9609, Wall-Mounted.
2. "Tyco/Simplex Grinnell" #2088-9610, Floor-Mounted, Single Door.
3. "Tyco/Simplex Grinnell" #2088-9611, Floor-Mounted, Double Door.

B. Description:
1. Shall be furnished for door(s) as indicated on the drawings.
2. Provide type as indicated on the drawings. Where not indicated, provide wall-mounted units. If specific condition does not permit wall-mounted units, consult Architect for ability to use floor-mounted units.
3. Wall-Mounted units shall be surface mount and shall include semi-flush magnet, cover assembly, catch plate, matching electrical box housing, and surface-mount box.
4. Floor-Mounted units shall include magnet(s), catch plate(s), housing, mounting plate, gasket, and mounting hardware.
5. Provide back plate on opposite side of hollow doors, for reinforcing catch plate.
6. Provide chrome catch plate extender rod as required for length and reach needed.

C. Provide wall and floor mounted magnetic door holders for single or double doors as indicated on the drawings. Coordinate the type and location with the door manufacturer's shop drawings and field installer.

D. Door holders shall be constructed of brushed stainless steel with a long-life electromagnet designed to release the doors when smoke or heat is detected by a local detector. Door closer will be provided in another section of these specifications. Doors may be manually opened and closed at any time.

E. Door holders shall be powered from the control panel.

2.11 PROTECTIVE GUARDS AND COVERS

A. Shall be clear, tamperproof, UV stabilized polycarbonate shield and frame specially designed to custom fit the specific fire alarm devices they protect. Shields to be slotted for all types of audible devices.

B. If allowed by the Architect, chrome plated heavy wire guards may be used in lieu of polycarbonate shields.

C. In areas where to be installed, install on all manual alarm stations, alarm signals, smoke detectors, heat detectors, etc.

D. Areas of installation to include all spaces prone to impact on a regular basis such as gymnasiums, mechanical rooms, custodial rooms, storage rooms and similar spaces.

PART 3 - EXECUTION

3.01 DESIGN AND INSTALLATION DRAWINGS

A. Show a general layout of the complete system including equipment arrangement. It shall be the responsibility of the fire alarm contractor to verity dimensions and assure compatibility all other systems interfacing with the fire alarm system.
1. Identify on the drawings, conduit and conductor sizes and types with number of conductors in each conduit. Provide each conduit and device with a unique identification for addressable alarm initiation devices, the system identifier shall be the system address for that device.
2. Indicate on the point to point wiring diagrams, interconnecting wiring within the panel between modules and connecting wiring to the field device terminals.

3.02 DEMOLITION

A. Contractor shall remove all the existing system components.
All components, devices and wiring installed shall be new.

B. Contractor shall coordinate the work so that the Fire Alarm System, either new or existing, is in full operation while building is occupied by the public.

C. Should it become necessary to make the existing Fire Alarm Systems inoperative, ample notification shall be given to the Owner, and the Architect/Engineer. Architect/Engineer will issue additional written instructions that are to be provided at this Contractor's expense.

D. All existing fire alarm equipment shall remain the properly of the Owner and shall be stored off-site by the Contractor at a central location where directed by the Owner.

3.03 WIRING

A. Fire alarm system wiring shall be installed with open plenum fire coded cable. Install wire neatly with bridal rings along walls. Maximum spacing 5'-0". Wire shall be of the size and type as recommended by system manufacturer but not smaller than #14 AWG. Wire shall be color coded throughout and tagged at each box and in the equipment cabinet for identification.

3.04 IDENTIFICATION

A. Fire alarm wiring in equipment cabinets shall be terminated on marked terminal strips. Tag wiring at both ends to correspond with wiring diagram. Arrange wire neatly in cabinets and lace with nylon cable straps. Cable terminations shall be arranged so that sections of the system may be isolated for servicing.

3.05 END OF LINE RESISTORS

A. End of Line Resistors shall be in separate outlet box in mechanical, electrical or storage space or above the corridor ceiling. Mark and locate on system drawings.

3.06 CONNECTIONS

In addition to the alarm devices specified here, other connections to the fire alarm system shall include but not limited to, the following:

A. From the fire alarm control panel, provide a connection to each manual alarm station, to each audio and visual alarm device and to each automatic detection device.

B. From the fire alarm control panel, provide connection to each fan motor controller.

C. From the fire alarm control panel, provide a connection to each kitchen hood system.

D. From the fire alarm control panel, provide a connection to the automatic dialer to the telephone terminal board.

E. From the fire alarm control panel, provide a connection to each electromagnetic door holder and access control power supplies and connection equipment.

F. From the fire alarm control panel, provide connection to each automatic fire sprinkler system device; Including but not limited to: riser flow, riser tamper, PIV, pit valves, zone valves, etc.

3.07 INSTALLATION

A. Perform work in accordance with the requirements of NEC, NFPA 70 and NFPA 72.

B. New devices can be surface mounted on existing walls.

3.08 CERTIFICATE OF COMPLIANCE

A. Complete and submit to the Project Architect in accordance with NFPA 72, paragraph 2.2.2.

3.09 CLEANING

A. Vacuum clean inside of all boxes, cabinets and equipment when work is complete.

SUBMITTAL CHECKLIST

1. Manufacturer's catalog data cut sheets.
2. Complete full size installation drawings.
3. Power calculations.

END OF SECTION 13850

SECTION 13930 - WET PIPE FIRE SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work included under this Section of the Specifications consists of the furnishing of all materials and equipment, obtaining and paying for all permits required, and the performing of the labor and services required for complete and operating automatic fire sprinkler system. This includes design, layout, shop drawings, approvals, all items of material and labor, and all other costs to complete the installation.

B. Types of work in this section include (but are not limited to) the following:
   1. Sprinkler O.S. and Y. Gates.
   2. Overhead mains and risers.
   3. Branch lines and sprinkler heads.
   4. Drains, inspector's tests and flushing connections.
   5. Gauges.
   6. Shop drawings and operating instructions.
   7. Pipe sleeves, hangers, supports, etc.
   8. Waterflow and valve supervisory devices.
      (Waterflow switch, pressure switch and O.S. and Y. position indicator switches).
   9. Fire service water connections to city water main.
   10. Fire department connections.
   11. Exterior fire service lines.
   12. Service vaults and valve pits.
   13. Stage standpipe and hose connections.
   14. Stair standpipe and hose connections.
   15. Dry system requirements for combined systems, wet and dry zones from same riser headers.
   16. Emergency Access Knox-Box.

C. Prepare all drawings, calculations, and applications required to obtain approval of the system by all state and local authorities having jurisdiction.

D. See Fire Protection Drawings, Site Utility Plans, Plumbing and Electrical, for additional requirements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 09900 - Painting
Section 15050 - Basic Mechanical Requirements
Section 15420 - Plumbing Piping Outside Building
Division 16 - Electrical

1.03 QUALITY ASSURANCE

A. Licensed fire protection contractor with current certification to perform work in the state, county and city where work is located.

B. Install work in accordance with the regulatory requirements of the following:
   1. State Building Code, current edition.
   2. NFPA 13.
   3. UL Listed, Underwriter's Laboratory.
   4. FM Approved, Factory Mutual, pamphlet 20 - rules for installing sprinklers.
   5. State Safety Code for Elevators and Escalators.
   6. State Fire Marshal.
   7. City/County Fire Marshal.

8. State insurance service offices.

1.04 SUBMITTALS

A. Submissions for Approval:
   1. Submit required shop drawings and hydraulic calculations to State Fire Protection Bureau, local Fire Marshal, and local Fire Chief for review and approval.
   2. Submit evidence of meetings with local Fire Marshal and local Fire Chief, as part of the submittals package to the Architect.
   3. Once approvals of these plans is obtained from the above-mentioned authorities, submit six (6) copies of complete submittals to the Architect.
   4. Contractor to make all submittals for permits and approvals and as required per all State regulations and requirements.

B. Shop Drawings:
   1. Must be legible prints of clear sharp tracings, prepared at scale equal to that of the plans in the Drawings and must be shown along with piping, sprinklers, etc.
   2. Indicate each area of installation as to zone included within and riser served from.
   3. Indicate construction and installation of each area including ceiling and roof heights.
   4. Prepare using a reference all of the architectural, structural, mechanical, plumbing and electrical drawings. Match room names, numbers, and general project nomenclature.
   5. Submit reflected ceiling plans to Architect for final approval prior to fabrication. Contractor shall exercise special attention to coordinate head location layouts in ceilings.
   6. Architect will make available, at no cost, base xref drawings in Autocad format for fire protection contractor's use in preparing shop drawings.
   7. Architect to review layout for purposes of aesthetics and design intent, not for coverage or capacity of the sprinkler system or system design.

C. Product Literature:
   1. Manufacturer's cutsheets and product literature for all materials included in the system.

D. Calculations:
   1. Designs and calculations must be certified by a registered design professional licensed to design systems in the State of installation.
   2. Design per hazard classifications as indicated on the Drawings.
   3. Indicate on plans areas and hazard classifications of submitted calculations for reference.

E. At the completion of the work provide a small scale plan of the building, indicating the locations of all control valves, low point drains, and inspectors test. The plans shall be neatly drawn.

1.05 DELIVERY, STORAGE AND HANDLING

A. Arrange deliveries in quantities to permit continuity of installation.

B. Store materials off ground and under cover to prevent rusting, denting and other damage and deterioration prior to installation.

1.06 PROJECT DESIGN REQUIREMENTS

A. Design system for the occupancies and hazards as listed on the drawings.

B. Design the complete system according to the criteria outlined on the plans and specifications.

C. Contractor is responsible for meeting with local Fire Marshal and local Fire Chief to insure the system meets all local requirements and they are all incorporated into the system design.

D. Contractor is responsible for meeting with local water utility to insure the system meets all requirements for the local utility coordination, connections, and equipment. Coordinate approval and acceptance of equipment service items with utility.

E. No additional compensation will be considered for local official or utility requirements that may not have been indicated on the plan.

F. Contractor is responsible for conducting a flow test for use in determination of sprinkler system design requirements. Coordinate with local utility and/or fire department.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Sprinkler Heads:
   1. Recessed Pendent Sprinklers in Ceilings:
      a. Rated for Hazard Classifications as indicated on the Drawings.
      b. Quick Response, Standard or Extended coverage.
      c. White polyester coated head and escutcheon.
      d. Surface pendents or extended escutcheons types are not acceptable.
   2. Upright Pendent Sprinklers at Exposed Structure:
      a. Rated for Hazard Classifications as indicated on the Drawings.
      b. Quick Response, Standard or Extended coverage.
      c. Brass head.
      d. Provide wire guards in gymnasiums, mechanical rooms, industrial areas, and like conditions.
   3. Sidewall Sprinklers:
      a. Rated for Hazard Classifications as indicated on the Drawings.
      b. Quick Response, Standard or Extended coverage.
      c. White polyester coated head and escutcheon.
   4. Dry Pendent Sprinklers in Coolers/Freezers:
      a. Rated for Hazard Classifications as indicated on the Drawings.
      b. Quick Response, Standard or Extended coverage.
      c. Chrome head and escutcheon.
   5. Dry Pendent Sprinklers in Other Locations:
      a. Rated for Hazard Classifications as indicated on the Drawings.
      b. Quick Response, Standard or Extended coverage.
      c. Head and escutcheon to match others in exposed areas.
      d. Brass head where not exposed to view.

B. Pipe:
   1. Black Steel:
      a. Schedule 40 (1" – 2").
      b. Schedule 10 (2-1/2" – 8").
      c. 300 psi maximum working pressure rating.
      d. ASTM A-135.
   2. Meet NFPA tests and requirements for:
      a. Welded Outlets.
      b. Hydrostatic Pressure.
      c. Side Wall Rupture.
      d. Vibration Test.

C. Fittings:
   1. Cast Iron, Threaded:
      a. Class 125 (standard).
      b. ANSI B16.14.
   2. Cast Iron, Flanged:
      a. Class 250 (extra heavy).
      b. ASME B16.1.
      c. Flanged bolts shall be hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated, ANSI B18.2.
   3. Malleable Iron:
      a. Class 150 and Class 300.
   4. Rigid Couplings and Fittings:
      a, Ductile Iron.
      b. ASTM A-536.
      c. Gasket material shall be Grade "A" EPDM.

D. Flexible Sprinkler Head Drops:
   1. Basis of specification: “Easy Flex USA”, EasyFlex Sprinkler Drops.
   2. Used in lieu of hard-piped head drops to lay-in grid ceiling systems.
   3. Corrugated stainless steel flexline pipe tubing, braided or unbraided.
   4. Manufacturer’s standard T-bar and T-bar brackets as required and as appropriate to the ceiling grid system being installed into.
   5. Manufacturer’s standard snap clamps to secure the sprinkler head to the T-bar.
   6. Provide all nipples, nuts, reducers, isolation rings, gaskets, clamps, brackets, bar, etc. required for a complete installation.
   7. Take care to not crimp bends or pinch lines of installation to obstruct flow.

E. Pipe Hangers:
   1. Carbon steel with plated finish.
   2. Adjustable swivel ring.
   3. Suitable for structural system without use of expansion bolts.
   4. Provide all threaded rods as required, material and finish to match hangers.
   5. Provide steel beam clamps as required, material and finish to match hangers.

F. Riser Valves, Check Valves, and Butterfly Valves:
   1. Ductile Iron.
   2. Vertical or horizontal configuration and orientation as most appropriate for area and layout of install.

G. Double Check Assemblies:
   1. Designed to prevent backflow of pollutants, that are objectionable but not toxic, from entering the potable water supply system.
   2. Designed to be under continuous service pressure while possibly subjected to simultaneous backflow pressure or back siphonage.
   3. Consist of two independent check modules within a single housing nd two drip tight shut-off valves.
   4. Contains integral by-pass meter to monitor water flow in gallons per minute.

H. Post-Indicator Valves:
   1. Field adjust for install to height per NFPA requirements.
   2. Set the "Open" and "Shut" targets for the appropriate valve size.
   3. Standpipe above ground and head top section to be painted red.

I. Fire Department Connections:
   1. Install in freestanding post configuration on site, atop service vault or a through-wall configuration directly on building as indicated on the Drawings and as required by state and local authorities.
   2. Designed for connection of fire department hoses to supplement water supply.
   3. Field adjust for install to height per NFPA requirements.
   4. Designed to provide minimum 250 gpm flow per each 2-1/2" inlet.
   5. Cast brass, two way inlet body with drop clappers.
   6. Polished brass plate with lettering "Fire Department Connection".
   7. Two polished brass double female snoots, plugs and chains.
   8. Threads as approved by local Fire Marshal or Fire Chief. Contractor to field verify.
   9. 1/2" automatic ball drip between check valve and fire department connection.

J. Drains:
   1. 2" drain risers.
   2. Main drain line at riser to exterior of building.
   3. Pipe to suitable hub or floor drains inside building.
   4. Auxiliary drains at low points and where otherwise necessary.
   5. Coordinate location and routing of drain lines with Architect.

K. Signs:
   1. Standard metal signs.
   2. Meet all requirements of NFPA 13.

L. Alarms:
   1. Bells:
      a. Rated for indoor or outdoor use.
      b. Red powder coated finish.
      c. Provide weather-proof backbox for all outdoor installations.
      d. Provide electrical to bells as required for proper operation.
   2. Flow Switches:
      a. Provide downstream of the butterfly valve for each riser zone.
      b. Approved for use on steel pipe.
      c. Actuated when a flow of 10 gpm minimum occurs downstream of device.
      d. Contains an adjustable, instantly recycling pneumatic retard. Select and set retard period.
      e. Provide electrical to switches as required for proper operation.
   3. Tamper/Supervisory Switches:
      a. Provide at butterfly valve for each riser zone.
      b. Provide at post indicator valve for system.
      c. Weatherproof and tamperproof switch to monitor open valve positions.
      d. Mechanically activated by cover removal or moving the integral trip rod.
      e. Provide electrical to switches as required for proper operation.

M. Spare-Head Cabinet:
   1. Metal cabinet with lock and continuous piano hinge door.
   2. Provide two (2) of each type head installed on project.
   3. Required tools for replacement.
   4. Mount at riser location.

N. Service Vault:
   1. Provide as indicated on the Drawings and as required by state and local authorities.
   2. Submersible Sump Pump:
      a. Provide equal to: “Liberty Pumps”, Model 231.

b. Quick disconnect type with wide angle float.
c. 1/3 hp, 1-1/2" discharge, 120 volt, 3450 rpm.

3. If detail is not indicated on drawings, provide vault with the following minimum requirements:
   a. Precast concrete vault, size as required by code, sprinkler contractor and local officials. Provide manhole cover on top face for access into vault.
   b. Double Check with Bypass Meter, on supports.
   c. Central OS&Y gate valve ahead of Double Check, with Post Indicator Valve (PIV) atop vault.
   d. Central OS&Y gate valve as an inline maintenance check valve downstream of Double Check
   e. Fire Department Connection atop vault downstream from the inline maintenance check valve.
   f. Submersible sump pump on GFI duplex outlet within vault at top near manhole cover. Provide plug and cord power connection to sump pump.
   g. Provide bituminous damproofing on all surfaces of vault below grade, sides and bottom.
   h. Provide thru sealant mastic or tape at all seams between vault panels.
   i. Grout and seal all penetrations thru vault.

O. Stage Standpipe and Hose Connections:
   1. Provide as indicated on the Drawings and as required by NFPA and state and local authorities.
   2. Whether indicated or not, provide the following minimum standpipe requirements:
      a. Provide a wet standpipe system with both 1-1/2" and 2-1/2" hose connections.
      b. Class of standpipe to be as required by Code and NFPA.
      c. Provide at each side of the stage.
      d. All hose connections, threads, and fittings shall be approved by local jurisdiction and match hoses of the local fire department.
   3. Whether indicated or not, provide the following minimum hose and cabinet requirements:
      a. The 1-1/2" hose connections shall be equipped with sufficient lengths of 1-1/2" hose to provide fire protection for the entire stage area.
      b. Hose connections shall be equipped with an approved adjustable fog nozzle.
      c. Mount hose connections and hose in a cabinet or rack as required by Code and NFPA.
      d. All hose connections, threads, and fittings shall be approved by local jurisdiction and match hoses of the local fire department.
   4. If allowed by Code and NFPA, make the following exceptions to standpipe requirements:
      a. Delete the requirements to provide the standpipe and connections as listed above.
      b. Provide a 1-1/2" hose connection connected to the fire sprinkler system.
      c. Provide proper cap and chain for the hose connection valve assembly.
      d. Provide at each side of the stage.
      e. All hose connections, threads, and fittings shall be approved by local jurisdiction and match hoses of the local fire department.
   5. If allowed by Code and NFPA, make the following exceptions to hose and cabinet requirements:
      a. Delete the requirements to provide the hose and fog nozzle as listed above.
      b. Delete the requirements to provide the rack or cabinet as listed above.
      c. Provide proper cap and chain for the hose connection valve assembly.
      d. All hose connections, threads, and fittings shall be approved by local jurisdiction and match hoses of the local fire department.

P. Stair Standpipe and Hose Connections:
   1. Provide as indicated on the Drawings and as required by NFPA and state and local authorities.
   2. Whether indicated or not, provide the following minimum standpipe requirements:
      a. Provide a Class I wet standpipe system with 2-1/2" hose connections.
      b. All hose connections, threads, and fittings shall be approved by local jurisdiction and match hoses of the local fire department.
   3. Locate hose connection at intermediate landing between floor levels.
      If multiple landings exist, locate on landing most closely located midway between floor levels.

Q. Dry System:
   1. Basic Requirements:
      a. Include all components as required to meet all requirements for a combined system per NFPA 13, Chapter 7.
      b. Proper items and components as required to separate piping at riser to create a dry system header for a combined system distribution throughout.
      c. Includes, but is not limited to, dry pipe valves, check valves, bypass valves, indicating valves, relief valves, pressure gauges, drains, tripping device, exhauster, air compression, piping, heads and connections.
      d. Dry system riser to begin at dry pipe valve and make proper connection to the wet system riser piping and components.
      e. Provide a listed quick-opening device and all associated components, unless specifically not required.
      f. Provide a listed anti-flooding device and all associated components, unless specifically not required, installed in the connection between the dry pipe sprinkler riser and the quick-opening device.
   2. Air Pressure:
      a. If not available from any other source within the project, provide an air compressor specifically for the system, with all piping, connections and components as required.
      b. Maintain the required air pressure on the system at all times, with a permanent connection to the dry pipe system from an air compressor.
      c. Provide 1/2" minimum pipe connection from the air compressor to the dry system riser and enter the system above the priming water level of the dry pipe valve.
      d. Install a check valve in the air line. Include a shut-off valve on the supply side of this check valve and shall remain closed unless filling the system.
      e. Provide a relief valve between the air compressor and the controlling valve to be set to relieve the system as required.
      f. Where an air line is taken from a larger system serving other uses, provide a regulator as required to maintain proper pressure on the dry pipe system. Provide a relief valve to be set to relieve the system as required. Provide backflow prevention device as required for coordination of line with other use lines.

R. Emergency Access Knox-Box:
   1. Provide as indicated on the Drawings and as required by NFPA and state and local authorities. If not otherwise indicated, provide a single recessed mount cabinet located as required by local authorities and as coordinated with the Architect.
      A surface mount unit may be used only as specifically permitted by the Architect.
   2. Recessed Mount Cabinet:
      a. “Knox Company”; Knox-Box 3200 Series.
      b. 4”H x 5”W x 3”D, 1/4" thick plate steel housing, fully welded.
      c. 1/2" thick plate steel door with interior gasket seal and stainless steel hinge.
      d. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key. Lock to have a 1/8” thick stainless steel dust cover with tamper seal mounting capability.
      e. UL Listed box and lock.
      f. Recessed mounting with galvanized or stainless steel thru-bolts through wall per manufacturer’s recommendations. Recessed Mounting Kit with 6-1/2”H x 6-1/2”W x 5”D shell backbox.
      g. 7”H x 7”W face flange.
      h. Color: Aluminum.
   3. Surface Mount Cabinet:
      a. “Knox Company”; Knox-Box 3200 Series.
      b. 4”H x 5”W x 3-3/4”D, 1/4" thick plate steel housing, fully welded.

c. 1/2" thick plate steel door with interior gasket seal and stainless steel hinge.
d. Double-action rotating tumblers and hardened steel pins accessed by a biased cut key. Lock to have a 1/8” thick stainless steel dust cover with tamper seal mounting capability.
e. UL Listed box and lock.
f. Surface mounting with galvanized or stainless steel thru-bolts through wall per manufacturer’s recommendations.
g. Color: Aluminum.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install complete per IBC Section 903 and NFPA 13.

B. Furnish and install wet pipe automatic sprinklers system of first quality in every and all respects, together with the necessary pipe, fittings, hangers, and other apparatus necessary for a complete and finished installation, in conformance with present standards of NFPA and all state and local authorities.

C. All sprinkler piping must be substantially supported from building structure and only approved type hangers used. Sprinkler lines under ducts shall not be supported from ductwork, but shall be supported from building structure with trapeze hangers where necessary.

D. Coordinate work with work of other trades to avoid conflicts and interference and allow proper execution of all work. Do not damage or displace work of other trades.

E. Contractor shall make no changes in installation from layout as shown on approved shop drawings unless such change is specifically approved by the Architect. Any changes made other than as above stated, are at the Contractor's own expense and responsibility.

F. Provide flushing connections in cross mains as specified in the latest NFPA Standards, Pamphlet No. 13.

G. Sprinkler heads shall be centered in all suspended acoustical ceiling panels.

H. Replace acoustic ceiling panels damaged due to installation of sprinkler heads.

I. Inspector's test connection, consisting of 1" piping, 1" globe valve, and 1/2" special discharge nozzle, shall be installed and connected to the systems at points as required by NFPA and all authorities having jurisdiction.

J. Connect the sprinkler system to the fire alarm system per NFPA requirements. Sprinkler system shall be electronically supervised per IBC 903.4 and NFPA.

3.02 PHASING

A. Charge system so as to place in service all areas of the fire sprinkler system required to provide protection to all areas and spaces as construction is completed and prior to Owner occupancy.

B. Installation of system shall allow for expansion and phasing of project.

C. Coordinate zoning of installation of system as required to avoid use of any shut-off valves within the system, other than at the main riser, to minimize the number of monitoring points in the system.

D. It may be necessary, due to phasing, sequencing of construction, to avoid additional shut-off valves,

requirements of the Fire Marshall, or any other reason, to drain and recharge the system after initial charging. This may need to be done multiple times during the construction process. This work shall be figured into the bid and accomplished by the Contractor at no additional costs.

3.03 ADJUSTING, TESTING AND CLEANING

A. All sprinkler piping shall be tested for a period of two hours at a hydrostatic pressure of 200 lbs. and all piping, valves, heads, etc., shall be watertight.

B. All piping shall be thoroughly flushed in accordance with the requirements of the latest NFPA Standards, Pamphlet No. 13, and flush test must be witnessed by proper authority.

C. Architect's representative shall be notified in advance regarding time and date of all tests.

D. During the installation and testing period of the sprinkler system, the Contractor shall be responsible for any damage to the work of others, to the building, its contents, etc., caused by leaks in any equipment by unplugged or disconnected pipes, fittings, etc., or by overflow and shall pay for necessary replacements or repairs to work by others, building, fixtures or merchandise damaged by such leakage.

E. Clean all exposed piping, fittings, heads and other accessories.
Polish all sprinkler heads in finished areas.

F. Repair or replace damaged or marred items.

G. Remove debris from work area.

SUBMITTAL CHECK LIST

1. Submissions for Approval.
2. Approvals from State Fire Protection Bureau, Local Fire Marshal, and local Fire Chief.
3. Shop Drawings.
4. Product Literature.
5. Calculations.

END OF SECTION 13930

SECTION 15005 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

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.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class F.

H. Code Letter Designation:
1. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

B. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15005

SECTION 15006 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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.

1.2 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on alternating-current power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

B. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet (1000 m) above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Rotor: Random-wound, squirrel cage.

E. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating.

G. Insulation: Class F.

H. Code Letter Designation:
1. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.

B. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

C. Motors 1/20 HP and Smaller: Shaded-pole type.

D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15006

SECTION 15061 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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.

1.2 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Pipe stands.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Pipe stands.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Include design calculations for designing trapeze hangers.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated, or epoxy powder-coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe and Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-plated steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-plated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-58, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Description: Shop- or field-fabricated, pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
3. Channels: Continuous slotted carbon-steel channel with inturned lips.
4. Channel Width: Selected for applicable load criteria.
5. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
7. Metallic Coating: Electroplated zinc or Hot-dip galvanized.
8. Paint Coating: [**Green epoxy, acrylic, or urethane**] <**Insert paint type**>.

2.4 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psi (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psi (862-kPa) minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psi (688-kPa) or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psi (862-kPa) minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.5 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand:

1. Description: Single base unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Hardware: Galvanized steel or polycarbonate.
4. Accessories: Protection pads.

C. Low-Profile, Single Base, Single-Pipe Stand:

1. Description: Single base with vertical and horizontal members, and pipe support, for roof installation without membrane protection.
2. Base: Single, vulcanized rubber, molded polypropylene, or polycarbonate.
3. Vertical Members: Two, galvanized-steel, continuous-thread 1/2-inch (12-mm) rods.
4. Horizontal Member: Adjustable horizontal, galvanized-steel pipe support channels.
5. Pipe Supports: Roller, Clevis hanger or Swivel hanger.
6. Hardware: Galvanized steel.
7. Accessories: Protection pads.
8. Height: 12 inches (300 mm) above roof.

2.6 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.7 MATERIALS

A. Carbon Steel: ASTM A 1011/A 1011M.

B. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.

C. Stainless Steel: ASTM A 240/A 240M.

D. Threaded Rods: Continuously threaded. Zinc-plated or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar materials as rods.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

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 plus 200 lb (90 kg).

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-58. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled strut systems.

D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

E. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65)

and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 3/4 to NPS 6 (DN 20 to DN 150): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.3 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.4 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.5 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches (40 mm).

3.6 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.7 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

G. Use thermal-hanger shield inserts for insulated piping and tubing.

H. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F (566 deg C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 (DN 15 to DN 600) if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
5. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
6. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
7. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).
8. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3 (DN 10 to DN 80).
9. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
10. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
11. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
12. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 (DN 65 to DN 900) if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
13. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

I. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).
    c. Heavy (MSS Type 33): 3000 lb (1360 kg).

L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.

N. Comply with MSS SP-58 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

END OF SECTION 15061

SECTION 15075 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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.

1.2 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Valve tags.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve numbering scheme.

E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch (0.8-mm) or stainless steel, 0.025-inch (0.64-mm) minimum thickness and having predrilled or stamped holes for attachment hardware.
2. Letter Color: Red.
3. Background Color: White.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
5. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm),

and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

6. Fasteners: Stainless-steel self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
7. Fasteners: Stainless-steel self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color: Red.

C. Background Color: Black.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F (71 deg C).

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size: 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.

G. Fasteners: Stainless-steel self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm) and proportionately larger lettering for greater viewing distances.

2.4 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers.

1. Tag Material: stainless steel, 0.025-inch (0.64-mm) minimum thickness and having predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire-link chain or S-hook.

B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch (A4) bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints and encapsulants.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

3.3 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

C. Pipe Label Color Schedule:

1. Low-Pressure Compressed Air Piping:

a. Background: Safety blue.
b. Letter Colors: White.

2. Domestic Water Piping

a. Background: Safety green.
b. Letter Colors: White.

3. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Safety black.
b. Letter Color: White.

3.5 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

    a. Cold Water: 1-1/2 inches (38 mm).
    b. Hot Water: 1-1/2 inches (38 mm).
    c. Low-Pressure Compressed Air: 1-1/2 inches (38 mm), round shape.

2. Valve-Tag Colors:

    a. Cold Water: Natural.
    b. Hot Water: Natural.
    c. Low-Pressure Compressed Air: Natural.

3. Letter Colors:

    a. Cold Water: White.
    b. Hot Water: White.
    c. Low-Pressure Compressed Air: White.

END OF SECTION 15075

SECTION 15081 - PLUMBING PIPING INSULATION

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.

1.2 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic cold-water piping.
2. Domestic hot-water piping.
3. Domestic recirculating hot-water piping.
4. Sanitary waste piping exposed to freezing conditions.
5. Storm-water piping exposed to freezing conditions.
6. Roof drains and rainwater leaders.
7. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

C. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

B. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
4. Preformed Pipe Insulation with Factory-Applied ASJ or ASJ-SSL: Comply with ASTM C 552, Type II, Class 2.
5. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1.

H. Mineral-Fiber, Preformed Pipe Insulation:
1. Type I, 850 Deg F (454 Deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ or with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.033 metric perm) at 30-mil (0.8-mm) dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F (Minus 46 to plus 104 deg C).
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets and substrates.

1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
3. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
4. Color: White.

2.6 SEALANTS

A. Joint Sealants for Cellular-Glass Products:
1. Materials shall be compatible with insulation materials, jackets and substrates.

2. Permanently flexible, elastomeric sealant.
3. Service Temperature Range: Minus 100 to plus 300 deg F (Minus 73 to plus 149 deg C).
4. Color: White or gray.

B. FSK Sealants:
1. Materials shall be compatible with insulation materials, jackets and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
1. Adhesive: As recommended by jacket material manufacturer.
2. Color: White.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.9 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.

6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches (50 mm).
2. Thickness: 6 mils (0.15 mm).
3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.10 SECUREMENTS

A. Bands:
1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.062-inch (1.6-mm) soft-annealed, stainless steel.

2.11 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:
1. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:
1. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils (0.127 mm) thick and an epoxy finish 5 mils (0.127 mm) thick if operating in a temperature range between 140 and 300 deg F (60 and 149 deg C). Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.

2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install

insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids and irregular surfaces with insulating cement finished to a smooth, hard and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve

stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.

5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.9 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with

weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.10 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below:

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe and three locations of threaded fittings, for each pipe service defined in the "Piping Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.12 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.13 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:

1. NPS 1 (DN 25) and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1/2 inch (13 mm) or 3/4 inch (19 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

2. NPS 1-1/4 (DN 32) and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

B. Domestic Hot and Recirculated Hot Water:

1. NPS 1-1/4 (DN 32) and Smaller: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 3/4 inch (19 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.

2. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Flexible Elastomeric: 1 inch (25 mm) thick.
c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

C. Stormwater and Overflow:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

D. Roof Drain and Overflow Drain Bodies:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 1/2 inch (13 mm) thick.

F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet (3 m) of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.

G. Hot Service Drains:

1. All Pipe Sizes: Insulation shall be one of the following:

a. Cellular Glass: 1-1/2 inches (38 mm) thick.
b. Mineral-Fiber, Preformed Pipe, Type I or II: 1 inch (25 mm) thick.

H. Hot Service Vents:

1. All Pipe Sizes: Insulation shall be the following:

a. Cellular Glass: 1-1/2 inches (38 mm).

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:
1. PVC: 20 mils (0.5 mm) thick.

3.15 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 15081

SECTION 15082 - DUCT INSULATION

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.

1.2 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, concealed return located in unconditioned space.
3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
4. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
5. Outdoor, concealed supply and return.
6. Outdoor, exposed supply and return.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

H. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.

1.
2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
3. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
5. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.

1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
2. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
3. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches (75 mm).

2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches (50 mm).
2. Thickness: 6 mils (0.15 mm).
3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches (50 mm).
2. Thickness: 3.7 mils (0.093 mm).
3. Adhesion: 100 ounces force/inch (1.1 N/mm) in width.
4. Elongation: 5 percent.
5. Tensile Strength: 34 lbf/inch (6.2 N/mm) in width.

2.8 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.
2. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated.

2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- (2.6-mm-) diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch (38-mm) galvanized carbon-steel washer.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
   a. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

4. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- (0.41-mm-) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

2.9 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

B. Stainless-Steel Corner Angles: 0.024 inch (0.61 mm) thick, minimum 1 by 1 inch (25 by 25 mm), stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Section "Penetration Firestopping."

C. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section" Penetration Firestopping."

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1-inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not over compress insulation during installation.
    e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1-inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

    a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.

3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

B. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

3.7 FINISHES

A. Insulation with ASJ: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
5. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
6. Outdoor, concealed supply and return.
7. Outdoor, exposed supply and return.

B. Items Not Insulated:
1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, round and flat-oval, supply-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

B. Concealed, round and flat-oval, return-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

C. Concealed, round and flat-oval, outdoor-air duct insulation shall be one of the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 1.5-lb/cu. ft. (24-kg/cu. m) nominal density.
2. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

D. Concealed, round and flat-oval, exhaust-air duct insulation shall be the following:
1. Mineral-Fiber Blanket: 1-1/2 inches (38 mm) thick and 0.75-lb/cu. ft. (12-kg/cu. m) nominal density.

E. Concealed, rectangular, supply-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

F. Concealed, rectangular, return-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

G. Concealed, rectangular, outdoor-air duct insulation shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

H. Concealed, rectangular, exhaust-air duct insulation between isolation damper and penetration of building exterior shall be the following:
1. Mineral-Fiber Board: 1-1/2 inches (38 mm) thick and 3-lb/cu. ft. (48-kg/cu. m) nominal density.

END OF SECTION 15082

SECTION 15083 - HVAC PIPING INSULATION

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.

1.2 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Condensate drain piping, indoors.

2. Condenser-water piping.
3. Refrigerant suction and hot-gas piping, indoors and outdoors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

C. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Block Insulation: ASTM C 552, Type I.
2. Special-Shaped Insulation: ASTM C 552, Type III.
3. Board Insulation: ASTM C 552, Type IV.
4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.

G. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F (minus 73 to plus 93 deg C).

C. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm (0.03 metric perm) at 35-mil (0.9-mm) dry film thickness.
2. Service Temperature Range: 0 to 180 deg F (Minus 18 to plus 82 deg C).
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
2. Service Temperature Range: 0 to plus 180 deg F (Minus 18 to plus 82 deg C).
3. Color: White.

2.6 SEALANTS

A. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Width: 3 inches (75 mm).
2. Thickness: 11.5 mils (0.29 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.

4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Width: 3 inches (75 mm).
2. Thickness: 6.5 mils (0.16 mm).
3. Adhesion: 90 ounces force/inch (1.0 N/mm) in width.
4. Elongation: 2 percent.
5. Tensile Strength: 40 lbf/inch (7.2 N/mm) in width.
6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Width: 2 inches (50 mm).
2. Thickness: 6 mils (0.15 mm).
3. Adhesion: 64 ounces force/inch (0.7 N/mm) in width.
4. Elongation: 500 percent.
5. Tensile Strength: 18 lbf/inch (3.3 N/mm) in width.

2.9 SECUREMENTS

A. Bands:

1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304; 0.015 inch (0.38 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.

C. Wire: 0.080-inch (2.0-mm) nickel-copper alloy.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
   1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F (0 and 149 deg C) with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF CELLULAR-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, three locations of threaded valves.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Condensate and Equipment Drain Water below 60 Deg F (16 Deg C):

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 3/4 inch (19 mm) thick.

B. Condenser-Water Supply and Return:

1. NPS 4 (DN 100) and Smaller: Insulation shall be the following:

   a. Cellular Glass: 1-1/2 inches (38 mm) thick.

C. Refrigerant Suction and Hot-Gas Piping:

1. All Pipe Sizes: Insulation shall be the following:
   a. Flexible Elastomeric: 1 inch (25 mm) thick.

D. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

   a. Flexible Elastomeric: 1 inch (25 mm) thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Condenser-Water Supply and Return:

1. All Pipe Sizes: Insulation shall be the following:

   a. Cellular Glass: 2 inches (50 mm) thick.

B. Refrigerant Suction and Hot-Gas Flexible Tubing:

1. All Pipe Sizes: Insulation shall be the following:

a. Flexible Elastomeric: 2 inches (50 mm) thick.

3.13 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Condenser-Water Supply and Return, All Sizes: Cellular glass, 2 inches (50 mm) thick.

END OF SECTION 15083

SECTION 15106 - FACILITY NATURAL-GAS PIPING

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.

1.2 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Manual gas shutoff valves.
5. Pressure regulators.
6. Service meters.

1.3 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:

1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

1. Shop Drawing Scale: 1/4 inch per foot (1:50).

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.

B. Welding certificates.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pressure regulators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

1.8 DELIVERY, STORAGE AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.9 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:

1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of natural-gas service.

2. Do not proceed with interruption of natural-gas service without Architect's and Owner's written permission.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig (690 kPa) minimum unless otherwise indicated.
2. Service Regulators: 65 psig (450 kPa) minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: More than 0.5 psig (3.45 kPa) but not more than 2 psig (13.8 kPa).

2.2 PIPES, TUBES AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.

4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

5. Mechanical Couplings:
a. Stainless-steel flanges and tube with epoxy finish.
b. Buna-nitrile seals.
c. Stainless-steel bolts, washers, and nuts.
d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
1. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
2. Coating: PE with flame retardant.

a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 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.

3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
4. Striker Plates: Steel, designed to protect tubing from penetrations.
5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
6. Operating-Pressure Rating: 5 psig (34.5 kPa).

C. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated, and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering vent casing, aboveground.
c. Aboveground Portion: PE transition fitting.
d. Outlet shall be threaded or flanged or suitable for welded connection.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig (3.45 kPa).
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches (1830 mm.)
9.

B. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.5 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig (862 kPa).
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.

C. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.
1. Body: Bronze, complying with ASTM B 584.
2. Ball: Chrome-plated bronze.
3. Stem: Bronze; blowout proof.
4. Seats: Reinforced TFE; blowout proof.
5. Packing: Threaded-body packnut design with adjustable-stem packing.
6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
7. CWP Rating: 600 psig (4140 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Bronze Plug Valves: MSS SP-78.
1. Body: Bronze, complying with ASTM B 584.
2. Plug: Bronze.
3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
4. Operator: Square head or lug type with tamperproof feature where indicated.
5. Pressure Class: 125 psig (862 kPa).
6. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Cast-Iron, Lubricated Plug Valves: MSS SP-78.
1. Body: Cast iron, complying with ASTM A 126, Class B.
2. Plug: Bronze or nickel-plated cast iron.
3. Seat: Coated with thermoplastic.

4. Stem Seal: Compatible with natural gas.
5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
6. Operator: Square head or lug type with tamperproof feature where indicated.
7. Pressure Class: 125 psig (862 kPa).
8. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. PE Ball Valves: Comply with ASME B16.40.
1. Body: PE.
2. Ball: PE.
3. Stem: Acetal.
4. Seats and Seals: Nitrile.
5. Ends: Plain or fusible to match piping.
6. CWP Rating: 80 psig (552 kPa).
7. Operating Temperature: Minus 20 to plus 140 deg F (Minus 29 to plus 60 deg C).
8. Operator: Nut or flat head for key operation.
9. Include plastic valve extension.
10. Include tamperproof locking feature for valves where indicated on Drawings.

G. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches (125 mm) in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.6 MOTORIZED GAS VALVES

A. Automatic Gas Valves: Comply with ANSI Z21.21.
1. Body: Brass or aluminum.
2. Seats and Disc: Nitrile rubber.
3. Springs and Valve Trim: Stainless steel.
4. Normally closed.
5. Visual position indicator.
6. Electrical operator for actuation by appliance automatic shutoff device.

2.7 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 (DN 50) and smaller; flanged for regulators NPS 2-1/2 (DN 65) and larger.

B. Service Pressure Regulators: Comply with ANSI Z21.80.
1. Body and Diaphragm Case: Cast iron or die-cast aluminum.

2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
5. Orifice: Aluminum; interchangeable.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
9. Overpressure Protection Device: Factory mounted on pressure regulator.
10. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
11. Maximum Inlet Pressure: 100 psig (690 kPa).

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 2 psig (13.8 kPa).

2.8 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.

1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
2. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches (38 mm) of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
3. In Floor Channels: Install natural-gas piping in floor channels. Channels must have cover and be open to space above cover for ventilation.
4. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.

    a. Exception: Tubing passing through partitions or walls does not require striker barriers.

5. Prohibited Locations:

    a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    b. Do not install natural-gas piping in solid walls or partitions.

Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

R. Connect branch piping from top or side of horizontal piping.

S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

T. Do not use natural-gas piping as grounding electrode.

U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

V. Install pressure regulator at each appliance to provide the correct operational pressure at the appliance.

3.4 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.

B. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

C. Install anode for metallic valves in underground PE piping.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

F. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.6 HANGER AND SUPPORT INSTALLATION

A. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 (DN 25) and Smaller: Maximum span, 96 inches (2438 mm); minimum rod size, 3/8 inch (10 mm).
2. NPS 1-1/4 (DN 32): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).
3. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): Maximum span, 108 inches (2743 mm); minimum rod size, 3/8 inch (10 mm).

3.7 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches (1800 mm) of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Install detectable warning tape directly above gas piping, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.9 PAINTING

A. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

1. Latex Over Alkyd Primer System: MPI INT 5.1Q.

a. Prime Coat: Alkyd anticorrosive metal primer.
b. Intermediate Coat: Interior latex matching topcoat.
c. Topcoat: Interior latex (flat).
d. Color: Gray.

B. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG (3.45 kPa) AND LESS THAN 5 PSIG (34.5 kPa)

A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
1. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be the following:

1. Steel pipe with malleable-iron fittings and threaded joints.

3.14 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2 (DN 50) and smaller shall be one of the following:
1. Two-piece, full-port, bronze ball valves with bronze trim.
2. Bronze plug valve.

END OF SECTION 15106

SECTION 15107 - GROUND-LOOP HEAT-PUMP PIPING

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.

1.2 SUMMARY

A. Section includes piping for vertical, encased, ground-loop, heat-pump systems.

1.3 ACTION SUBMITTALS

A. Thermal Conductivity Test

B. The testing shall include a test bore and thermal conductivity testing for the site. Thermal conductivity testing agent shall wait 5-day minimum after drilling before conducting their testing. Testing shall be for a minimum continuous forty-eight (48) hour period. Methodology endorsed by IGSHPA is required. On-site testing data shall be provided to the architect and engineer in electronic format of all actual relevant bore and site conditions including but not limited to:

C. Driller shall provide a 400 ft. deep well with “Finished Loop” and the following:
1. Total depth (400 ft.)
2. Borehole diameter (in.)
3. Undisturbed ground temperature (ºF)
4. Strata log denoting formations and approximate thickness.
5. Static water level (ft. from datum)

D. Thermal conductivity testing agent shall provide:
1. Loop fill and purge information
2. Minute by minute readings over entire test.
3. Testing flow rate-constant.
4. Input heat rate-constant.

E. Thermal conductivity is to be provided in units of BTUH/ft. ºF. The accuracy of temperature measurement and recording devices shall be +/-0.5 degrees F. The accuracy of the power transducer and recording device should be +/- 2% of the reading.

F. The undisturbed ground temperature measurement should be made at the end of the 5-day waiting period by direct insertion of a probe inside a liquid-filled ground heat exchanger at three locations, representing the average, or by the measurement of temperature as the liquid exits the loop during the period immediately following start-up.

G. Test rigs shall be enclosed in a sealed cabinet that is insulated with a minimum of 1.0” fiberglass insulation. All above ground piping should be insulated with a minimum of 0.5” closed-cell insulation.

H. If any retesting is necessary, the loop temperature should be allowed to return to within 0.5 degrees F of the pretest initial ground temperature.

I. It is the intent that the test bore will be incorporated into the actual well field should the project proceed. The driller will be provided with a location for the test bore prior to commencement of work.

J. The result of the test bore will determine the total number of wells needed to achieve the required heat rejection/absorption for the water-source heat pump system. Refer to Section "Unit Prices Form" for cost submission during the bid process.

K. Final Well Field Layout
1. The well field contractor shall provide a scaled drawing indicating each bore location, bore depth, bore diameter, pipe routing, pipe sizes, and calculated pressure drop.

L. Product Data: For each type of product.

1. Pipe and fittings.
2. Joining method and equipment.
3. Propylene glycol solution.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Borehole backfilling and drilling operations reports.

C. Dimensioned site layout.

D. Startup performance results.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. HDPE Pipe: ASTM D 3035.

B. Molded PE Fittings: ASTM D 2683 or ASTM D 3261, ASTM F 1055 PE resin, socket, butt-fusion or electro-fusion type, made to match PE pipe dimensions and class.

C. U-Bend Assembly: Factory fabricated with embossed depth stamp every 24 inches from U-bend.

D. Ground-Loop, Heat-Pump Piping Minimum Working Pressure: 160 psig.

E. Ground-Loop, Heat-Pump Piping Operating Temperature: Between 23 and 104 deg F.

2.2 BOREHOLE BACKFILL

A. Seal Material: Bentonite clay with thermal conductivity greater than 1.07 Btu/h x sq. ft. x deg F according to ASTM D 5334.

B. Permeability: Not more than 1 nm/s according to ASTM D 5084

2.3 ANTIFREEZE SOLUTION

A. Propylene Glycol: Minimum 99 percent propylene glycol with corrosion inhibitors and environmental stabilizer additives to be mixed with water to protect piping circuit and connected equipment from physical damage caused by freezing or corrosion.

B. Quantity: Sufficient solution for initial system startup and for preventive maintenance for one year from date of Substantial Completion.

C. Dilution Water: Chloride content shall be less than 25 ppm, sulfate content less than 25 ppm, and hardness less than 100 ppm.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, warning tape, and backfilling are specified in Section 312000 "Earth Moving."

3.2 HORIZONTAL PIPING INSTALLATION

A. Separate trenches by 10 feet minimum unless otherwise indicated. Remove rocks in trenches that could contact pipe.

B. Backfill

C. Extend pipe from trench onto bottom of body of water at an elevation that is at least 12 inches below frost line. Seal membrane or impervious liner under body of water after installing piping.

D. Install HDPE piping in trenches according to ASTM D 2774 or ASTM F 645.

1. Clean HDPE pipe and fittings and make heat-fusion joints according to ASTM D 2657. Minimize number of joints.

E. Purge, flush, and pressure test piping before backfilling trenches.

F. Install continuous detectable warning tape for underground piping. Locate tape a minimum of 24 inches below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."

3.3 VERTICAL PIPING INSTALLATION

A. Install HDPE piping in boreholes according to ASTM D 2774 or ASTM F 645.

1. Clean HDPE pipe and fittings and make heat-fusion joints according to ASTM D 2657. Minimize number of joints.

B. Purge, flush, and pressure test piping before backfilling boreholes.

C. Completely fill the borehole from bottom to top with backfill material.

D. Install the header piping 4 to 6 inches deep and install the horizontal piping from the header to the boreholes.

E. Extend the horizontal piping and connect to ground-loop heat-pump piping systems at outside face of building wall in locations and pipe sizes indicated.

1. Terminate water-service piping at building wall until building ground-loop heat-pump piping systems are installed. Terminate piping with caps. Make connections to building ground-loop heat-pump piping systems when those systems are installed.

F. Backfill the horizontal piping and header trenches.

G. Fill the entire piping loop with water or antifreeze solution.

H. Maintain records of backfilling on-site.

I. Mark borehole locations, header pipes, and horizontal runs with metallic locator tape.

J. Seal penetrations through building walls.

3.4 ANTIFREEZE SOLUTION FILL

A. Fill system with required quantity of propylene glycol and water to provide minus 10 deg F freezing temperature.

B. Test dilute solution using gas chromatography to verity concentration of propylene glycol, and forward report to Architect.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

3.6 FIELD QUALITY CONTROL

A. Piping Tests: Fill piping 24 hours before testing and apply test pressure to stabilize piping. Use potable water only.

B. Hydrostatic Tests: Test at not less than 1-1/2 times the pipe working-pressure rating or 300 percent of system design pressure, whichever is more, allowing for static pressure of borehole depth.

1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 30 minutes. Slowly increase to next test pressure increment and hold for 30 minutes. After testing at maximum test pressure, reduce pressure to 30 psig. Hold for 90 minutes, and measure pressure at 30-minute intervals. Repair leaks and retest until no leaks exist.
2. Maintain a minimum pipe velocity of 24 in./s for a minimum of 15 minutes to remove all air.

C. Prepare test and inspection reports.

END OF SECTION 15107

SECTION 15111 - BALL VALVES FOR PLUMBING PIPING

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.

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

   1. Certification that products comply with NSF 61 Annex G.

1.5 DELIVERY, STORAGE AND HANDLING

A. Prepare valves for shipping as follows:

   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and soldered ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.

C. NSF Compliance: NSF 61 Annex G for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:

1. Gear Actuator: For quarter-turn valves NPS 4 (DN 100) and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4 (DN 100).

H. Valves in Insulated Piping:

1. Include 2-inch (50-mm) stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

I. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
1. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig (4140 kPa).
c. Body Design: Two piece.
d. Body Material: Bronze.
e. Ends: Threaded or soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 15075 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.
3. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.4 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG (1035 kPa) OR LESS)

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valves, two-piece with full port and brass trim.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
2. Brass ball valve, one piece.
3. Bronze ball valve, one piece with bronze or stainless-steel trim.
4. Brass ball valves, two-piece with full port and stainless-steel trim.

END OF SECTION 15111

SECTION 15112 - CHECK VALVES FOR PLUMBING PIPING

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.

1.2 SUMMARY

A. Section Includes:
   1. Bronze swing check valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene-diene terpolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

   1. Certification that products comply with NSF 61.

1.5 DELIVERY, STORAGE AND HANDLING

A. Prepare valves for shipping as follows:

   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, grooves, and weld ends.
   3. Set check valves in either closed or open position.

B. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded end valves.
2. ASME B16.18 for solder joint.

C. Drinking Water System Components - Health Effects and Drinking Water System Components - Lead Content Compliance: NSF 61 and NSF 372.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRONZE SWING CHECK VALVES

A. Bronze Swing Check Valves with Bronze Disc, Class 125:
1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: Bronze.

B. Bronze Swing Check Valves with Nonmetallic Disc, Class 125:
1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig (1380 kPa).
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded or soldered. See valve schedule articles.
f. Disc: PTFE.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Examine threads on valve and mating pipe for form and cleanliness.

C. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

D. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Check Valves: Install check valves for proper direction of flow.

1. Swing Check Valves: In horizontal position with hinge pin level.

F. Install valve tags. Comply with requirements in Section 15075 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Pump-Discharge Check Valves:

a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

B. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

C. End Connections:

1. For Copper Tubing, NPS 2 (DN 50) and Smaller: Threaded or soldered.
2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.
3. For Steel Piping, NPS 2 (DN 50) and Smaller: Threaded.
4. For Steel Piping, NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Flanged or threaded.

3.5 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc, Class 125, with soldered or threaded end connections.

END OF SECTION 15112

SECTION 15113 - BALL VALVES FOR HVAC PIPING

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.

1.2 SUMMARY

A. Section Includes:
   1. Bronze ball valves.
   2. Steel ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and weld ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:

1. ASME B1.20.1 for threads for threaded-end valves.
2. ASME B16.1 for flanges on iron valves.
3. ASME B16.5 for flanges on steel valves.
4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
5. ASME B16.18 for solder-joint connections.
6. ASME B31.9 for building services piping valves.

C. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

D. Refer to HVAC valve schedule articles for applications of valves.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
1. Handlever: For quarter-turn valves smaller than NPS 4 (DN 100).

H. Valves in Insulated Piping:

1. Include 2-inch (50-mm) stem extensions.
2. Extended operating handle of nonthermal-conductive material, and protective sleeves that allow operation of valves without breaking the vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

I. Valve Bypass and Drain Connections: MSS SP-45.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified SWP classes or CWP ratings are unavailable, the same types of valves with higher SWP classes or CWP ratings may be substituted.

B. Select valves with the following end connections:

1. For Copper Tubing, NPS 3 (DN 75) and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Steel Piping, NPS 3 (DN 75) and Smaller: Threaded ends.

3.4 CONDENSER-WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller: Bronze ball valves, two piece with stainless-steel trim, and full port.

1. Valves may be provided with solder-joint ends instead of threaded ends.

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Steel ball valves, Class 150.

END OF SECTION 15113

SECTION 15142 - DOMESTIC WATER PIPING SPECIALTIES

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.

1.2 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Temperature-actuated, water mixing valves.
5. Outlet boxes.
6. Hose stations.
7. Hose bibbs.
8. Wall hydrants.
9. Post hydrants.
10. Water-hammer arresters.
11. Air vents.
12. Trap-seal primer valves.
13. Trap-seal primer systems.
14. Flexible connectors.
15. Water meters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

B. Comply with NSF 372 for low lead.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 (860) psig (kPa) unless otherwise indicated.

2.3 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

B. Hose-Connection Vacuum Breakers:
1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
4. Finish: Rough bronze.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent Backflow Preventers:
1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Size: As indicated.
4. Body: Bronze.
5. End Connections: Union joint.
6. Finish: Rough bronze.

B. Reduced-Pressure-Principle Backflow Preventers:
1. Standard: ASSE 1013.
2. Operation: Continuous-pressure applications.
3. Pressure Loss: 12 (83) psig (kPa) maximum, through middle third of flow range.
4. Size: As indicated.
5. Body: Bronze for NPS 2 (DN 50) and smaller.
6. End Connections: Threaded for NPS 2 (DN 50) and smaller.

2.5 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
1. Standard: ASSE 1003.

2. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
3. Size: As indicated.
4. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3 (DN 65 and DN 80).
5. End Connections: Threaded for NPS 3 (DN 80) and smaller.

2.6 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:
1. Type: Ball or Y-pattern globe valve with two readout ports and memory-setting indicator.
2. Body: Bronze.
3. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
4. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

C. Memory-Stop Balancing Valves:
1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 2 (DN 50) or smaller.
4. Body: Copper alloy.
5. Port: Standard or full port.
6. Ball: Chrome-plated brass.
7. Seats and Seals: Replaceable.
8. End Connections: Solder joint or threaded.
9. Handle: Vinyl-covered steel with memory-setting device.

2.7 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:
1. Standard: ASSE 1017.
2. Pressure Rating: 125 psig (860 kPa).
3. Type: Thermostatically controlled, water mixing valve.
4. Material: Bronze body with corrosion-resistant interior components.
5. Connections: Threaded union inlets and outlet.
6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
7. Tempered-Water Setting: As indicated.
8. Valve Finish: Rough bronze.

2.8 OUTLET BOXES

A. Clothes Washer Outlet Boxes:
1. Mounting: Recessed.
2. Material and Finish: Plastic box and faceplate.
3. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
4. Supply Shutoff Fittings: NPS 1/2 (DN 15) gate, globe, or ball valves and NPS 1/2 (DN 15) copper, water tubing.
5. Drain: NPS 2 (DN 50) standpipe and P-trap for direct waste connection to drainage piping.

6. Inlet Hoses: Two 60-inch- (1500-mm-) long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.
7. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

B. Icemaker Outlet Boxes:
1. Mounting: Recessed.
2. Material and Finish: Plastic box and faceplate.
3. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 (DN 15) or smaller copper tube outlet.
4. Supply Shutoff Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

C. Hot- and Cold-Water Hose Stations:
1. Standard: ASME A112.18.1.
2. Faucet Type: Blending valve.
3. Cabinet: Stainless-steel enclosure with exposed valve handles, hose connection, and hose rack. Include thermometer in front.
4. Hose-Rack Material: Stainless steel.
5. Body Material: Bronze with stainless-steel wetted parts.
6. Body Finish: Rough bronze.
7. Mounting: Wall, with reinforcement.
8. Supply Fittings: Two NPS 3/4 (DN 20) gate, globe, or ball valves and check valves and NPS 3/4 (DN 20) copper, water tubing. Omit check valves if check stops are included with fitting.
9. Hose: Manufacturer's standard, for service fluid, temperature, and pressure; 25 (7.6) feet (m) long.
10. Nozzle: With hand-squeeze, on-off control.
11. Vacuum Breaker: Integral or factory-installed, nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052; and garden-hose thread complying with ASME B1.20.7 on outlet.

2.9 HOSE BIBBS

A. Hose Bibbs:
1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 3/4 (DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.10 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
2. Pressure Rating: 125 psig (860 kPa).
3. Operation: Loose key.
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
5. Inlet: NPS 3/4 (DN 20).
6. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
7. Box: Deep, flush mounted with cover.
8. Box and Cover Finish: Polished nickel bronze.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): One with each wall hydrant.

2.11 POST HYDRANTS

A. Nonfreeze, Draining-Type Post Hydrants:
1. Standard: ASME A112.21.3M.
2. Type: Nonfreeze, exposed-outlet post hydrant.
3. Operation: Loose key.
4. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
5. Casing: Bronze with casing guard.
6. Inlet: NPS 3/4 (DN 20).
7. Outlet: Garden-hose thread complying with ASME B1.20.7.
8. Drain: Designed with hole to drain into ground when shut off.
9. Vacuum Breaker:

a. Nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
b. Garden-hose thread complying with ASME B1.20.7 on outlet.

10. Operating Key(s): One with each loose-key-operation wall hydrant.

2.12 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP.
3. Size: NPS 3/4 (DN 20).
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
10. Drain: NPS 1/8 (DN 6) side outlet with cap.

2.13 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows or Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.14 AIR VENTS

A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig (860-kPa) minimum pressure rating at 140 deg F (60 deg C).
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 3/8 (DN 10) minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.

2.15 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:
1. Standard: ASSE 1018.
2. Pressure Rating: 125 psig (860 kPa) minimum.
3. Body: Bronze.
4. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
5. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
6. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.16 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:
1. Standard: ASSE 1044.

2.17 FLEXIBLE CONNECTORS

A. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded copper pipe or plain-end copper tube.

B. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig (1380 kPa).
2. End Connections NPS 2 (DN 50) and Smaller: Threaded steel-pipe nipple.

2.18 WATER METERS

A. Turbine-Type Water Meters:
1. Standard: AWWA C701.
2. Pressure Rating: 150 (1035) psig (kPa) working pressure.
3. Body Design: Turbine; totalization meter.
4. Registration: In gallons (liters) or cubic feet (cubic meters) as required by utility company.
5. Case: Bronze.
6. End Connections for Meters NPS 2 (DN 50) and Smaller: Threaded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Backflow Preventers: Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Water Regulators: Install with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Balancing Valves: Install in locations where they can easily be adjusted.

D. Temperature-Actuated, Water Mixing Valves: Install with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

E. Outlet Boxes: Install boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs.

F. Hose Stations: Install with check stops or shutoff valves on inlets and with thermometer on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified. Install 2-by-4-inch (38-by-89-mm) fire-retardant-treated-wood blocking, wall reinforcement between studs.

G. Nonfreeze, Draining-Type Post Hydrants: Install with 1 (0.75) cu. yd. (cu. m) of crushed gravel around drain hole. Set post hydrants in concrete paving or in 1 (0.03) cu. ft. (cu. m) of concrete block at grade.

H. Water-Hammer Arresters: Install in water piping according to PDI-WH 201.

I. Air Vents: Install vents at high points of water piping. Install drain piping and discharge onto floor drain.

J. Supply-Type, Trap-Seal Primer Device: Install with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

3.3 IDENTIFICATION

A. Plastic Labels for Equipment: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Pressure vacuum breakers.
2. Intermediate atmospheric-vent backflow preventers.
3. Reduced-pressure-principle backflow preventers.
4. Water pressure-reducing valves.
5. Calibrated balancing valves.
6. Primary, thermostatic, water mixing valves.
7. Primary water tempering valves.
8. Outlet boxes.
9. Hose stations.
10. Supply-type, trap-seal primer valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 15075 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker and reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 15142

SECTION 15151 - SANITARY WASTE AND VENT PIPING

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.

1.2 SUMMARY

A. Section Includes:
1. Hubless, cast-iron soil pipe and fittings.
2. Ductile-iron pipe and fittings.
3. PVC pipe and fittings.
4. Specialty pipe fittings.
5. Encasement for underground metal piping.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

C. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections and details.

1.4 FIELD CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Architect and Owner no fewer than two days in advance of proposed interruption of sanitary waste service.
2. Do not proceed with interruption of sanitary waste service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa).

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

A. Pipe and Fittings: ASTM A 888 or CISPI 301.

B. Single-Stack Aerator Fittings: ASME B16.45, hubless, cast-iron aerator and deaerator drainage fittings.

C. CISPI, Hubless-Piping Couplings:
1. Standards: ASTM C 1277 and CISPI 310.
2. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

D. Heavy-Duty, Hubless-Piping Couplings:
1. Standards: ASTM C 1277 and ASTM C 1540.
2. Description: Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

E. Cast-Iron, Hubless-Piping Couplings:
1. Standard: ASTM C 1277.
2. Description: Two-piece ASTM A 48/A 48M, cast-iron housing; stainless-steel bolts and nuts; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 DUCTILE-IRON PIPE AND FITTINGS

A. Ductile-Iron, Mechanical-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with mechanical-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, mechanical-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Glands, Gaskets, and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Ductile-Iron, Push-on-Joint Piping:

1. Ductile-Iron Pipe: AWWA C151/A21.51, with push-on-joint bell and plain spigot ends unless grooved or flanged ends are indicated.
2. Ductile-Iron Fittings: AWWA C110/A21.10, push-on-joint, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
3. Gaskets: AWWA C111/A21.11, rubber.

2.5 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

E. Adhesive Primer: ASTM F 656.

F. Solvent Cement: ASTM D 2564.

2.6 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
2. Unshielded, Nonpressure Transition Couplings:
   a. Standard: ASTM C 1173.
   b. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
   c. End Connections: Same size as and compatible with pipes to be joined.
   d. Sleeve Materials:

      1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
      2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

3. Shielded, Nonpressure Transition Couplings:
   a. Standard: ASTM C 1460.
   b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
   c. End Connections: Same size as and compatible with pipes to be joined.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.

1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.

1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.

    a. Straight tees, elbows, and crosses may be used on vent lines.

3. Do not change direction of flow more than 90 degrees.
4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.

    a. Reducing size of waste piping in direction of flow is prohibited.

K. Lay buried building waste piping beginning at low point of each system.

1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
3. Maintain swab in piping and pull past each joint as completed.

L. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

M. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."

1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

O. Install sleeves for piping penetrations of walls, ceilings and floors.

P. Install sleeve seals for piping penetrations of concrete walls and slabs.

Q. Install escutcheons for piping penetrations of walls, ceilings and floors.

3.2 JOINT CONSTRUCTION

A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.3 HANGER AND SUPPORT INSTALLATION

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Vertical Piping: MSS Type 8 or Type 42, clamps.
4. Install individual, straight, horizontal piping runs:

    a. 100 Feet (30 m) and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet (30 m): MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet (30 m) if Indicated: MSS Type 49, spring cushion rolls.

5. Multiple, Straight, Horizontal Piping Runs 100 Feet (30 m) or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
6. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting and coupling.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.

E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 60 inches (1500 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 60 inches (1500 mm) with 1/2-inch (13-mm) rod.

3. NPS 4 and NPS 5 (DN 100 and DN 125): 60 inches (1500 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 60 inches (1500 mm) with 3/4-inch (19-mm) rod.

F. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).

G. Install supports for vertical copper tubing every 10 feet (3 m).

H. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
3. NPS 4 and NPS 5 (DN 100 and DN 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
4. NPS 6 and NPS 8 (DN 150 and DN 200): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.

I. Install supports for vertical PVC piping every 48 inches (1200 mm).

J. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

3.4 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:

1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Equipment: Connect waste piping as indicated.

a. Provide shutoff valve if indicated and union for each connection.
b. Use flanges instead of unions for connections NPS 2-1/2 (DN 65) and larger.

3.5 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 15075 "Identification for Plumbing Piping and Equipment."

3.6 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended or repaired.

    a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.

    a. Expose work that was covered or concealed before it was tested.

3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.

    a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water (30 kPa).
    b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    c. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.

    a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg (250 Pa).
    b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    d. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.7 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.8 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be the following:
1. Hubless, cast-iron soil pipe and fittings and hubless, single-stack aerator fittings hubless-piping couplings; and coupled joints.

C. Aboveground, vent piping NPS 4 (DN 100) and smaller shall be the following:

1. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
2. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
3. Dissimilar Pipe-Material Couplings: Unshielded, nonpressure transition couplings.

D. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be the following:
1. Hubless, cast-iron soil pipe and fittings; hubless-piping couplings; and coupled joints.

END OF SECTION 15151

SECTION 15201 - HYDRONIC PIPING SPECIALTIES

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.

1.2 SUMMARY

A. Section Includes:

1. Hydronic specialty valves.
2. Air-control devices.
3. Strainers.
4. Connectors.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product:

1. Include construction details and material descriptions for hydronic piping specialties.
2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
3. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For hydronic piping specialties to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.6 QUALITY ASSURANCE

A. Safety Valves and Pressure Vessels: Shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

PART 2 - PRODUCTS

2.1 HYDRONIC SPECIALTY VALVES

A. Bronze, Calibrated-Orifice, Balancing Valves:
1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
2. Ball: Stainless steel.
3. Plug: Resin.
4. Seat: PTFE.
5. End Connections: Threaded.
6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
7. Handle Style: Lever, with memory stop to retain set position.
8. CWP Rating: Minimum 125 psig (860 kPa).
9. Maximum Operating Temperature: 250 deg F (121 deg C).

B. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves:
1. Body: Cast-iron or steel body, ball, plug, or globe pattern with calibrated orifice or venturi.
2. Ball: Stainless steel.
3. Stem Seals: EPDM O-rings.
4. Disc: Glass and carbon-filled PTFE.
5. Seat: PTFE.
6. End Connections: Flanged or threaded.
7. Pressure Gage Connections: Integral seals for portable differential pressure meter.
8. Handle Style: Lever, with memory stop to retain set position.
9. CWP Rating: Minimum 125 psig (860 kPa).
10. Maximum Operating Temperature: 250 deg F (121 deg C).

C. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
1. Body: Bronze or brass.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Bronze or stainless steel.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Low inlet-pressure check valve.
7. Inlet Strainer: 304 stainless steel.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

D. Diaphragm-Operated Safety Valves: ASME labeled.
1. Body: Bronze.
2. Disc: Glass and carbon-filled PTFE.
3. Seat: Bronze or 304 stainless steel.
4. Stem Seals: EPDM O-rings.
5. Diaphragm: EPT.
6. Wetted, Internal Work Parts: Brass and rubber.
7. Inlet Strainer: 304 stainless steel, removable without system shutdown.
8. Valve Seat and Stem: Noncorrosive.
9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Automatic Flow-Control Valves:
1. Body: Brass or ferrous metal.
2. Flow Control Assembly, provide either of the following:

a. Piston and Spring Assembly: Stainless steel, tamper proof, self-cleaning, and removable.
b. Elastomeric Diaphragm and Polyphenylsulfone Orifice Plate: Operating ranges within 2- to 80-psig (14- to 550-kPa) differential pressure.

3. Combination Assemblies: Include bronze or brass-alloy ball valve.
4. Identification Tag: Marked with zone identification, valve number, and flow rate.
5. Size: Same as pipe in which installed.
6. Performance: Maintain constant flow within plus or minus 5 percent, regardless of system pressure fluctuations.
7. Minimum CWP Rating: 175 psig (1207 kPa).
8. Maximum Operating Temperature: 200 deg F (93 deg C).

2.2 AIR-CONTROL DEVICES

A. Manual Air Vents:
1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/8 (DN 6).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 225 deg F (107 deg C).

B. Automatic Air Vents:
1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/4 (DN 8).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 240 deg F (116 deg C).

C. Bladder-Type Expansion Tanks:
1. Tank: Welded steel, rated for 125-psig (860-kPa) working pressure and 375 deg F (191 deg C) maximum operating temperature. Factory test after taps are fabricated and supports installed and are labeled according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Bladder: Securely sealed into tank to separate air charge from system water to maintain required expansion capacity.
3. Air-Charge Fittings: Schrader valve, stainless steel with EPDM seats.

D. Coalescing-Type Air and Dirt Separators:
1. Tank: Fabricated steel tank; ASME constructed and stamped for 125-psig (862-kPa) working pressure and 270 deg F (130 deg C) maximum operating temperature.
2. Coalescing Medium: Stainless steel.
3. Air Vent: Threaded to the top of the separator.
4. Inline Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; Class 150 flanged connections for NPS 2-1/2 (DN 65) and larger.
5. Blowdown Connection: Threaded to the bottom of the separator.
6. Size: Match system flow capacity.

E. Tangential-Type Air Separators:
1. Tank: Welded steel; ASME constructed and labeled for 125-psig (860-kPa) minimum working pressure and 375 deg F (191 deg C) maximum operating temperature.

2. Air Collector Tube: Perforated stainless steel, constructed to direct released air into expansion tank.
3. Tangential Inlet and Outlet Connections: Threaded for NPS 2 (DN 50) and smaller; flanged connections for NPS 2-1/2 (DN 65) and larger.
4. Blowdown Connection: Threaded.
5. Size: Match system flow capacity.

2.3 STRAINERS

A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 60-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig (860 kPa).

2.4 CONNECTORS

A. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch (20-mm) misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

B. Spherical, Rubber, Flexible Connectors:

1. Body: Fiber-reinforced rubber body.
2. End Connections: Steel flanges drilled to align with Classes 150 and 300 steel flanges.
3. Performance: Capable of misalignment.
4. CWP Rating: 150 psig (1035 kPa).
5. Maximum Operating Temperature: 250 deg F (121 deg C).

PART 3 - EXECUTION

3.1 VALVE APPLICATIONS

A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.

B. Install calibrated-orifice, balancing valves at each branch connection to return main.

C. Install check valves at each pump discharge and elsewhere as required to control flow direction.

D. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.

3.2 HYDRONIC SPECIALTIES INSTALLATION

A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.

B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Install manual vents at heat-transfer coils and elsewhere as required for air venting.

C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.

D. Install tangential air separator in pump suction. Install blowdown piping with gate or full-port ball valve; extend full size to nearest floor drain.

E. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.

1. Install tank fittings that are shipped loose.
2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.

F. Install expansion tanks on the floor. Vent and purge air from hydronic system and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 15201

SECTION 15405 - HYDRONIC PUMPS

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.

1.2 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.

1.3 DEFINITIONS

A. Buna-N: Nitrile rubber.

B. EPT: Ethylene propylene terpolymer.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of pump. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated. Indicate pump's operating point on curves.

B. Shop Drawings: For each pump.

1. Show pump layout and connections.
2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.
3. Include diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Mechanical Seals: One mechanical seal(s) for each pump.

PART 2 - PRODUCTS

2.1 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.

B. Capacities and Characteristics: As scheduled.

C. Pump Construction:

1. Casing: Radially split, cast iron, with threaded gage tappings at inlet and outlet, replaceable bronze wear rings, and threaded companion-flange connections.
2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
3. Pump Shaft: Stainless steel.
4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal.
5. Seal: Packing seal consisting of stuffing box with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
6. Pump Bearings: Oil lubricated; bronze-journal or thrust type.

D. Motor: Single speed and rigidly mounted to pump casing.

1. 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.
2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 15006 "Common Motor Requirements for HVAC Equipment."

a. Enclosure: Open, dripproof.
b. Enclosure Materials: Rolled steel.
c. Motor Bearings: Grease-lubricated ball bearings.
d. Unusual Service Conditions:

1) Ambient Temperature: 100 deg F.
2) Altitude: 450 feet above sea level.

e. Efficiency: Premium efficient.
f. Service Factor: 1.15.

2.2 PUMP SPECIALTY FITTINGS

A. Triple-Duty Valve:

1. Angle or straight pattern.
2. 175-psig (1204-kPa) pressure rating, cast-iron body, pump-discharge fitting.
3. Drain plug and bronze-fitted shutoff, balancing, and check valve features.

4. Brass gage ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

C. Examine foundations and inertia bases for suitable conditions where pumps are to be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

A. Comply with HI 1.4 and HI 2.4.

B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.

D. Equipment Mounting: Install in-line pumps with continuous-thread hanger rods and spring hangers with vertical-limit stop of size required to support weight of in-line pumps.
1. Comply with requirements for hangers and supports specified in Section 15061 "Hangers and Supports for HVAC Piping and Equipment."

3.3 ALIGNMENT

A. Perform alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly.

3.4 CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install check valve and throttling valve with memory stop or triple-duty valve on discharge side of pumps.

E. Install Y-type strainer and shutoff valve on suction side of pumps.

F. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

G. Install single gage with multiple-input selector valve at integral pressure-gage tapping.

3.5 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:

    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.

5. Prime pump by opening suction valves and closing drains and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

END OF SECTION 15405

SECTION 15411 - COMMERCIAL WATER CLOSETS

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.

1.2 SUMMARY

A. Section Includes:

1. Water closets.
2. Flushometer valves.
3. Toilet seats.
4. Supports.

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet (9.1 m) from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

A. Water Closets: Wall mounted, top spud.
1. Bowl:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Type: Siphon jet.
d. Style: Flushometer valve.
e. Height: Standard or handicapped as applicable.
f. Rim Contour: Elongated.
g. Water Consumption: 1.28 gal. (4.8 L) per flush.
h. Spud Size and Location: NPS 1-1/2 (DN 40); top.

2. Water-Closet Mounting Height: Standard or Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:
1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig (860 kPa).
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Exposed.
8. Consumption: 1.28 gal. (4.8 L) per flush.
9. Minimum Inlet: NPS 1 (DN 25).
10. Minimum Outlet: NPS 1-1/4 (DN 32).

2.3 TOILET SEATS

A. Toilet Seats:
1. Standard: IAPMO/ANSI Z124.5.
2. Material: Plastic.
3. Type: Commercial (Heavy duty).
4. Shape: Elongated rim, open front.
5. Hinge: Self-sustaining.
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White.

2.4 SUPPORTS

A. Water Closet Carrier:
1. Standard: ASME A112.6.1M.
2. Description: Waste-fitting assembly, as required to match drainage piping material and arrangement with faceplates, couplings gaskets, and feet; bolts and hardware matching

fixture. Include additional extension coupling, faceplate, and feet for installation in wide pipe space.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
2. Use carrier supports with waste-fitting assembly and seal.
3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:

1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
4. Install actuators in locations that are easy for people with disabilities to reach.
5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

F. Joint Sealing:

1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to water-closet color.

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with soil and waste piping requirements specified in Section 15151 "Sanitary Waste and Vent Piping."

C. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 15411

SECTION 15412 - COMMERCIAL URINALS

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.

1.2 SUMMARY

A. Section Includes:

1. Urinals.
2. Flushometer valves.
3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for urinals.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than one of each type.

PART 2 - PRODUCTS

2.1 WALL-HUNG URINALS

A. Urinals: Wall hung, back outlet, blowout.
1. Fixture:

a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
b. Material: Vitreous china.
c. Strainer or Trapway: Manufacturer's standard strainer with integral trap.
d. Water Consumption: Water saving.
e. Spud Size and Location: NPS 1-1/4 (DN 32); top.
f. Outlet Size and Location: NPS 2 (DN 50); back.
g. Color: White.

2. Waste Fitting:

a. Standard: ASME A112.18.2/CSA B125.2 for coupling.
b. Size: NPS 2 (DN 50).

3. Support: Type I Urinal Carrier with fixture support plates and coupling with seal and fixture bolts and hardware matching fixture. Include rectangular, steel uprights.
4. Urinal Mounting Height: Standard or Handicapped/elderly according to ICC A117.1.

2.2 URINAL FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:
1. Standard: ASSE 1037.
2. Minimum Pressure Rating: 125 psig (860 kPa).
3. Features: Include integral check stop and backflow-prevention device.
4. Material: Brass body with corrosion-resistant components.
5. Exposed Flushometer-Valve Finish: Chrome plated.
6. Panel Finish: Chrome plated or stainless steel.
7. Style: Exposed.
8. Consumption: 0.5 gal. (1.9 L) per flush.
9. Minimum Inlet: NPS 3/4 (DN 20).
10. Minimum Outlet: NPS 1-1/4 (DN 32).

2.3 SUPPORTS

A. Type I Urinal Carrier:
1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before urinal installation.

B. Examine walls and floors for suitable conditions where urinals will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Urinal Installation:

1. Install urinals level and plumb according to roughing-in drawings.
2. Install wall-hung, back-outlet urinals onto waste fitting seals and attached to supports.
3. Install accessible, wall-mounted urinals at mounting height for the handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:

1. Install supports, affixed to building substrate, for wall-hung urinals.
2. Use off-floor carriers with waste fitting and seal for back-outlet urinals.
3. Use carriers without waste fitting for urinals with tubular waste piping.
4. Use chair-type carrier supports with rectangular steel uprights for accessible urinals.

C. Flushometer-Valve Installation:

1. Install flushometer-valve water-supply fitting on each supply to each urinal.
2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
3. Install lever-handle flushometer valves for accessible urinals with handle mounted on open side of compartment.
4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Wall Flange and Escutcheon Installation:

1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
2. Install deep-pattern escutcheons if required to conceal protruding fittings.

E. Joint Sealing:

1. Seal joints between urinals and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
2. Match sealant color to urinal color.

3.3 CONNECTIONS

A. Connect urinals with water supplies and soil, waste, and vent piping. Use size fittings required to match urinals.

B. Comply with soil and waste piping requirements specified in Section 15151 "Sanitary Waste and Vent Piping."

C. Where installing piping adjacent to urinals, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust urinals and controls. Replace damaged and malfunctioning urinals, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean urinals and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed urinals and fittings.

C. Do not allow use of urinals for temporary facilities unless approved in writing by Owner.

END OF SECTION 15412

SECTION 15413 - COMMERCIAL LAVATORIES

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.

1.2 SUMMARY

A. Section Includes:

1. Lavatories.
2. Faucets.
3. Supply fittings.
4. Waste fittings.
5. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
2. Include rated capacities, operating characteristics, electrical characteristics and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

A. Lavatory: Oval, enameled, cast iron, undercounter mounted.
   1. Fixture:

      a. Standard: ASME A112.19.1/CSA B45.2.
      b. Type: For undercounter mounting.
      c. Nominal Size: Oval, 19 by 16 inches (483 by 406 mm).
      d. Faucet-Hole Punching: No holes.
      e. Faucet-Hole Location: On countertop.
      f. Color: White.
      g. Mounting Materials: Sealant and undercounter mounting kit.
   2.

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Vitreous china, wall mounted, with back.
   1. Fixture:

      a. Standard: ASME A112.19.2/CSA B45.1.
      b. Type: For wall hanging.
      c. Nominal Size: Rectangular, 20” x 18” nominal.
      d. Faucet-Hole Punching: Three holes, 4-inch (102-mm) centers.
      e. Faucet-Hole Location: Top.
      f. Color: White.
      g. Mounting Material: Chair carrier.
   2. Lavatory Mounting Height: Standard or Handicapped/elderly according to ICC A117.1, as applicable.

2.3 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, single-control mixing, commercial, solid-brass valve.
   1. Standard: ASME A112.18.1/CSA B125.1.
   2. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
   3. Body Type: Centerset.
   4. Body Material: Commercial, solid brass.
   5. Finish: Polished chrome plate.
   6. Maximum Flow Rate: 0.5 gpm (1.5 L/min.).
   7. Mounting Type: Deck, exposed.
   8. Valve Handle(s): Single lever.
   9. Spout: Rigid type.
   10. Spout Outlet: Aerator.
   11. Drain: Not part of faucet.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 3/8 (DN 10).

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 (DN 32) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4 (DN 40 by DN 32).
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-(0.83-mm-) thick brass tube to wall.

2.6 SUPPORTS

A. Type II Lavatory Carrier:

1. Standard: ASME A112.6.1M.

B. Type III Lavatory Carrier:

1. Standard: ASME A112.6.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 15081 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with soil and waste piping requirements specified in Section 15151 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 15413

SECTION 15414 - COMMERCIAL SINKS

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.

1.2 SUMMARY

A. Section Includes:

1. Service basins.
2. Service sinks.
3. Utility sinks.
4. Handwash sinks.
5. Sink faucets.
6. Supports.
7. Supply fittings.
8. Waste fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sinks to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SERVICE BASINS (MOP SINK)

A. Service Basins: Stainless steel, floor mounted.
1. Fixture:

a. Standard: IAPMO PS 99.
b. Shape: Rectangular.
c. Nominal Size: 25” x 33”.
d. Height: 16 inches (305 mm) with dropped front.
e. Tiling Flange: Not required.
f. Color: Not applicable.
g. Drain: Grid with NPS 2 (DN 50) outlet.

2. Mounting: On floor and flush to wall.

2.2 UTILITY SINKS

A. Utility Sinks, SK-1: Stainless steel, counter mounted.
1. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Type: Ledge back.
c. Number of Compartments: Two.
d. Overall Dimensions: 32 x 18 x 9.
e. Metal Thickness: 18 gauge.
f. Compartments:

1) Dimensions: 14” x 16”.
2) Drain: Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain.
3) Drain Location: Centered in compartment.

2. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.
2) Risers: NPS 1/2 (DN 15), ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

3. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):

1) Size: NPS 1-1/2 (DN 40).
2) Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall; and chrome-plated brass or steel wall flange.

c. Continuous Waste:

1) Size: NPS 1-1/2 (DN 40).

2) Material: Chrome-plated, 0.032-inch- (0.83-mm-) thick brass tube.

4. Mounting: On counter with sealant.

B. Utility Sinks: 304 Stainless steel, undermount.
1. Fixture:

a. Standard: ASME A112.19.3/CSA B45.4.
b. Number of Compartments: One.
c. Overall Dimensions: 14 x 12 x 7.
d. Metal Thickness: 18 gauge.
e. Compartment:

1) Dimensions: 12 x 9 x 7.
2) Drain: Grid with NPS 1-1/2 (DN 40) tailpiece and twist drain.
3) Drain Location: Centered in compartment.

f. Drainboard(s): Not required.

2. Supports: Clips to mount sink to countertop.

3. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.
2) Risers: NPS 1/2 (DN 15), ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

4. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap(s):

1) Size: NPS 1-1/2 (DN 40).
2) Material: Chrome-plated, two-piece, cast-brass trap and ground-joint swivel elbow with 0.032-inch- (0.83-mm-) thick brass tube to wall; and chrome-plated brass or steel wall flange.

2.3 SINK FAUCETS

A. NSF Standard: Comply with NSF 372 for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, single control mixing valve.

1. Commercial, Solid-Brass Faucets: Bar sink faucet.

2. Commercial, Solid-Brass Faucets: Kitchen faucet.

3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
5. Body Type: Centerset.
6. Body Material: Commercial, solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 2.2 gpm (8.3 L/min.).
9. Handle(s): Lever.
10. Mounting Type: Deck, exposed.
11. Spout Type: Gooseneck with pull down spray.
12. Vacuum Breaker: Required for hose outlet.
13. Spout Outlet: Aerator.

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key.

2.5 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-hung sinks.

C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

D. Set floor-mounted sinks in leveling bed of cement grout.

E. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 15111 "Ball Valves for Plumbing Piping".
2. Install stops in locations where they can be easily reached for operation.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 15081 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with soil and waste piping requirements specified in Section 15151 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 15414

SECTION 15415 - COMMERCIAL SHOWERS

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.

1.2 SUMMARY

A. Section Includes:
   1. Shower faucets.
   2. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for showers and basins.
   2. Include rated capacities, operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For shower faucets to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
   2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 SHOWER FAUCETS

A. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for shower materials that will be in contact with potable water.

B. Shower Faucets
   1. Description: Single-handle, pressure-balance mixing valve with hot- and cold-water indicators; check stops; and shower head.
   2. Faucet:

a. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
b. Body Material: Solid brass.
c. Finish: Polished chrome plate.
d. Shower-Arm, Flow-Control Fitting: 2.0 gpm.
e. EPA Water Sense: Required.
f. Mounting: Exposed.
g. Operation: Single-handle, twist or rotate control.
h. Antiscald Device: Integral with mixing valve.
i. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

3. Supply Connections: NPS 1/2.
4. Shower Head:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Type: Ball joint with arm and flange.
c. Shower Head Material: Metallic with chrome-plated finish.
d. Spray Pattern: Adjustable.
e. Integral Volume Control: Not required.
f. Shower-Arm, Flow-Control Fitting: Not required.
g. Temperature Indicator: Not required.

2.2 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before shower installation.

B. Examine walls and floors for suitable conditions where showers will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Assemble shower components according to manufacturers' written instructions.

B. Install showers level and plumb according to roughing-in drawings.

C. Install water-supply piping with stop on each supply to each shower faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with shower. Comply with valve requirements specified in Section 15111 "Ball Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

D. Install shower flow-control fittings with specified maximum flow rates in shower arms.

E. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

F. Seal joints between showers and floors and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with traps and soil and waste piping requirements specified in Section 15151 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust showers and controls. Replace damaged and malfunctioning showers, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of showers and basins, inspect and repair damaged finishes.

B. Clean showers and basins, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed fixtures and fittings.

D. Do not allow use of showers and basins for temporary facilities unless approved in writing by Owner.

END OF SECTION 15415

SECTION 15416 - WASH FOUNTAINS

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.

1.2 SUMMARY

A. Section Includes:
   1. Linear wash fountains.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for wash fountains.

B. Shop Drawings: For each type of wash fountain.

   1. Include plans, elevations, sections, and mounting details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wash fountains and components to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

   1. Faucet Washers and O-Rings: Equal to 10 percent of quantity of each type and size installed.
   2. Faucet Cartridges and O-Rings: Equal to 5 percent of quantity of each type and size installed.

PART 2 - PRODUCTS

2.1 STAINLESS-STEEL, LINEAR WASH FOUNTAINS

A. Wash Fountains: Stainless-steel, linear (side-by-side) receptor.
1. Standard: IAPMO IGC 156.
2. 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.
3. Bowl(s) and Counter:

a. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel bowls.

b. Dimensions: 72” L x 20” D.
c. Height to Rim: 34 inches (864 mm) above floor.
d. Color or Finish: Not applicable.
e. Number of Bowls: One.
f. Drain: Grid with NPS 1-1/2 (DN 40) tailpiece, each bowl.

4. Pedestal: Not required.
5. Faucets:

a. Standards: ASME A112.18.1/CSA B125.1 and NSF 61 Annex G.
b. Type: Manufacturer's standard, chrome-plated solid brass, three places.
c. Control: Manual, 2 lever handles and gooseneck spout, mixing valve with check stops for each user station.
d. Sensor: ASME A112.18.1/CSA B125.1 and UL 1951.

6. Liquid-Soap Dispensers: Manual for each user station.

a. Sensor: ASME A112.18.1/CSA B125.1 and UL 1951.

7. Mounting: Off floor on wall brackets and ASME A112.6.1M.
8. Supply Fittings:

a. Piping: NPS 1/2 (DN 15) copper tubing, user station.
b. Valves: Shutoff valve on each supply.
c. Supply Piping: From wall.

9. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B125.2.
b. Trap and Drain Piping: NPS 1-1/2 (DN 40), each bowl.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water-supply, sanitary drainage, and vent piping systems to verify actual locations of piping connections before wash-fountain installation.

B. Examine walls and floors for suitable conditions where wash fountains will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wash fountains level and plumb according to roughing-in drawings.

B. Set freestanding wash fountains on floor.

C. Install off-floor carrier supports, affixed to building substrate, for wall-mounted wash fountains.

D. Install water-supply piping with shutoff valve on each supply to each wash fountain to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation.

E. Install trap and waste piping on each drain outlet of each wash fountain to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings.

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect wash fountains with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with requirements for soil and waste drainage piping and vent piping specified in Section 15151 "Sanitary Waste and Vent Piping."

C. Install protective-shielding pipe covers and enclosures on exposed supplies and waste piping of accessible wash fountains. Comply with requirements in Section 15081 "Plumbing Piping Insulation."

3.4 ADJUSTING

A. Operate and adjust wash fountains and controls. Replace damaged and malfunctioning wash fountains, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After installing wash fountains, inspect and repair damaged finishes.

B. Clean wash fountains, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed wash fountains and fittings.

D. Do not allow use of wash fountains for temporary facilities unless approved in writing by Owner.

END OF SECTION 15416

SECTION 15417 - EMERGENCY PLUMBING FIXTURES

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.

1.2 SUMMARY

A. Section Includes:
1. Combination units.
2. Water-tempering equipment.

B. Basis of Design: Bradley Halo Series without heat trace option.

1.3 DEFINITIONS

A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.

B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.

C. Self-Contained Emergency Plumbing Fixture: Fixture with flushing-fluid-solution supply.

D. Tepid: Moderately warm.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.

B. Shop Drawings: Diagram power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.

B. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Flushing-Fluid Solution: Separate lot and equal to at least 200 percent of amount of solution installed for each self-contained unit.

1.8 QUALITY ASSURANCE

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. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."

C. NSF Standard: Comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 COMBINATION UNITS

A. Standard, Plumbed Emergency Shower with Eyewash Combination Units:
1. Piping:

a. Material: Galvanized steel.
b. Unit Supply: NPS 1-1/2 (DN 40).
c. Unit Drain: Outlet at back or side near bottom.

2. Shower:

a. Capacity: Not less than 20 gpm (76 L/min.) for at least 15 minutes.
b. Supply Piping: NPS 1 (DN 25) with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Pull rod.
d. Shower Head: 8-inch- (200-mm-) minimum diameter, chrome-plated brass or stainless steel.
e. Mounting: Pedestal.

3. Eyewash Unit:

a. Capacity: Not less than 0.4 gpm (1.5 L/min.) for at least 15 minutes.
b. Supply Piping: NPS 1/2 (DN 15) with flow regulator and stay-open control valve.
c. Control-Valve Actuator: Paddle.
d. Spray-Head Assembly: Two receptor-mounted spray heads.
e. Receptor: Chrome-plated brass or stainless-steel bowl.
f. Mounting: Attached shower pedestal.

2.2 WATER-TEMPERING EQUIPMENT

A. Electric Water-Tempering Equipment:

1. Description: Factory-fabricated equipment with electric heating.

    a. Heating System: Electric, designed to provide 75 deg F (29 deg C) tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F (3 deg C) throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, heating coils, high-temperature-limit device, metal piping, and corrosion-resistant enclosure. Keltech or equal to be furnished with Bradley safety shower unit.

        1) Electrical Characteristics: 208-V ac, 38A, single phase, 60 Hz.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.

B. Install fixtures level and plumb.

C. Fasten fixtures to substrate.

D. Install shutoff valves in water-supply piping to fixtures. Use ball or gate valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation.

1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.

E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals.

F. Install thermometers in supply and outlet piping connections to water-tempering equipment.

G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system.

H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system.

I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations.

3.3 CONNECTIONS

A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.

B. Connect cold water and electrical power to electric heating water-tempering equipment.

C. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment.

3.5 FIELD QUALITY CONTROL

A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust or replace fixture flow regulators for proper flow.

B. Adjust equipment temperature settings.

END OF SECTION 15417

SECTION 15418 - PRESSURE WATER COOLERS

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.

1.2 SUMMARY

A. Section includes pressure water coolers and related components.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Four of each type.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers: Wall mounted, wheelchair accessible.
1. Standards:

a. Comply with NSF 61 Annex G.
b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethane) refrigerant unless otherwise indicated.

2. Cabinet: Bi-level with two attached cabinets, vinyl-covered steel with stainless-steel top.
3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
4. Control: Push bar.
5. Drain: Grid with NPS 1-1/4 (DN 32) tailpiece.
6. Supply: NPS 3/8 (DN 10) with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 (DN 32) brass P-trap.
8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

10. Capacities and Characteristics:

    a. Cooled Water: 8 gph (0.0084 L/s).
    b. Ambient-Air Temperature: 90 deg F (32 deg C).
    c. Inlet-Water Temperature: 80 deg F (27 deg C).
    d. Cooled-Water Temperature: 50 deg F (10 deg C).
    e. Electrical Characteristics:

        1) Rated Watts: 370.
        2) Volts: 120-V ac.
        3) Phase: Single.
        4) Hertz: 60.
        5) Full-Load Amperes: 5.0.

11. Support: Type I Water Cooler Carrier or Type II Water Cooler Carrier, as applicable.
12. Water Cooler Mounting Height: Standard and Handicapped/elderly according to ICC A117.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

C. Install mounting frames, affixed to building construction, and attach recessed, pressure water coolers to mounting frames.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation.

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings.

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color.

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Install ball shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler.

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 15418

SECTION 15481 - FUEL-FIRED, DOMESTIC WATER HEATERS

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.

1.2 SUMMARY

A. Section Includes:
   1. Commercial, power-vent, gas-fired, storage, domestic water heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic water heater indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

   1. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of commercial, gas-fired, domestic water heater, from manufacturer.

B. Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fuel-fired, domestic water heaters to include in emergency, operation and maintenance manuals.

1.6 QUALITY ASSURANCE

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. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 Annex G, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic water heaters that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including storage tank and supports.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.

2. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic Water Heaters:

1) Storage Tank: Five years.
2) Controls and Other Components: One year.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC WATER HEATERS

A. Commercial, Power-Vent, Gas-Fired, Storage, Domestic Water Heaters:
1. Standard: ANSI Z21.10.3/CSA 4.3.
2. Storage-Tank Construction: ASME-code steel with 150-psig (1035-kPa) working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.

b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Lining: Glass complying with NSF 61 Annex G barrier materials for potable-water tank linings, including extending lining into and through tank fittings and outlets.

3. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner: For use with power-vent, gas-fired, domestic water heaters and natural-gas fuel.
g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
h. Temperature Control: Adjustable thermostat.
i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

4. Special Requirements: NSF 5 construction.
5. Power-Vent System: Exhaust fan, interlocked with burner.

B. Capacity and Characteristics: As scheduled.

2.2 WATER HEATER ACCESSORIES

A. Water Compression Tanks:
1. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
2. Construction:

a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
b. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
c. Air-Charging Valve: Factory installed.

3. Capacity and Characteristics:

a. Working-Pressure Rating: 150 psig (1035 kPa).
b. Capacity Acceptable: 7 gal. (26.5 L) minimum.
c. Air Precharge Pressure: 12 psig.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic water heater and include drain outlet not less than NPS 3/4 (DN 20) with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 2-psig (13.8-kPa) pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic Water Heaters: ASME rated and stamped.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 WATER HEATER INSTALLATION

A. Commercial, Water Heater Mounting: Install commercial water heaters on concrete base. 4” thick approximately, 6” larger than the overall diameter of the water heater tank.
1. Maintain manufacturer's recommended clearances.
2. Arrange units so controls and devices that require servicing are accessible.
3. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
4. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
5. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
6. Install anchor bolts to elevations required for proper attachment to supported equipment.
7. Anchor domestic water heaters to substrate.

B. Install domestic water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic water-supply piping to domestic water heaters and on hot-water outlet piping.

C. Install gas-fired, water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 15106 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 15142 " Domestic Water Piping Specialties."

3.2 CONNECTIONS

A. Comply with requirements for gas piping specified in Section 15106 "Facility Natural-Gas Piping."

B. Drawings indicate general arrangement of piping, fittings, and specialties.

C. Where installing piping adjacent to fuel-fired, domestic water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 15075 "Identification for Plumbing Piping and Equipment."

3.4 COMBUSTION AIR

A. Provide a combustion air duct as indicated, with an on-off damper near the outside wall. Interact the damper actuator to open when any water heater pane vent starts.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Water heaters will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 15481

SECTION 15714 - FIXED PLATE AIR-TO-AIR ENERGY RECOVERY UNITS

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.

1.2 SUMMARY

A. Section Includes:

1. Fixed-plate sensible heat exchangers.
2. Fixed-plate total heat exchangers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings: For air-to-air energy recovery equipment.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Mechanical-room layout and relationships between components and adjacent structural and mechanical elements.
2. Support location, type, and weight.
3. Field measurements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air-to-air energy recovery equipment to include in maintenance manuals.

1.6 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver and store products in a clean, dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breakage, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.
3. Replace installed products damaged during construction.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of air-to-air energy recovery equipment that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

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, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE Compliance:

1. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
2. Capacity ratings for air-to-air energy recovery equipment shall comply with ASHRAE 84, "Method of Testing Air-to-Air Heat/Energy Exchangers."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 CAPACITIES AND CHARACTERISTICS: As scheduled.

2.3 FIXED-PLATE TOTAL HEAT EXCHANGERS

A. Casing: Aluminum>.

B. Drain Pan: Same material as casing, with drain connections on exhaust and supply side.

1. Comply with requirements in ASHRAE 62.1.

C. Plates: Evenly spaced, sealed, and arranged for counter airflow.

1. Plate Material and Coating: Chemically treated paper, or polymer on aluminum, with selective hydroscopicity, moisture permeability, and gas barrier properties.

D. Bypass Plenum: Within casing, with gasketed face-and-bypass dampers having operating rods extended outside casing.

E. Maximum Differential Pressure: Suitable for maximum 6-inch wg (1500 Pa).

F. Maximum Temperature: Suitable for maximum 194 deg F (90 deg C).

2.4 SOURCE QUALITY CONTROL

A. AHRI 1060 Certification: Certified according to AHRI 1060.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine 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 electrical services to verify actual locations of connections before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixed-plate heat exchangers so supply and exhaust airstreams flow in opposite directions.

1. Install duct access doors in both supply and exhaust ducts, both upstream and downstream, for access to heat exchanger

B. Equipment Mounting:
1. Suspend unit from roof structure with threaded rod attached to bar joists and angle iron base supports.

C. Install units with clearances for service and maintenance.

D. Comply with requirements for ductwork specified in Section 15810 "Metal Ducts."

3.3 PIPING CONNECTIONS

A. Condensate Drain Piping: Pipe drains from drain pans to nearest floor drain; use ASTM B 88, Type L (ASTM B 88M, Type B), drawn-temper copper water tubing with soldered joints, same size as condensate drain connection.

3.4 ELECTRICAL CONNECTIONS

A. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

B. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch (13 mm) high.

3.5 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

3.6 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper water wash control and unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
   3. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Air-to-air energy recovery equipment will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 STARTUP SERVICE

A. Perform startup service with the assistance of a factory-authorized service representative.

   1. Complete installation and startup checks according to manufacturer's written instructions.
   2. Verify that shipping, blocking, and bracing are removed.
   3. Verify that unit is secure on mountings and supporting devices and that connections to electrical systems are complete. Verify that proper thermal-overload protection is installed.

4. Verify water wash mechanism operation.

3.8 ADJUSTING

A. Comply with requirements in Section 15950 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

3.9 CLEANING

A. After completing system installation and testing, adjusting, and balancing air-to-air heat recovery unit, and after completing startup service, clean unit to remove foreign material and construction dirt and dust.

END OF SECTION 15714

SECTION 15731 - LOW-INTENSITY, GAS-FIRED, RADIANT HEATERS

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.

1.2 SUMMARY

A. Section includes low-intensity, gas-fired, draft-induced radiant heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of high-intensity, gas-fired, radiant heaters, as well as procedures and diagrams.
4. Include diagrams for power, signal and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Structural members to which equipment will be attached.
2. Gas piping to heater installations
3. Thermostats and wiring to heaters.
4. Heater locations and clearance requirements.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gas-fired, radiant heaters to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Igniter: One hot-surface burner igniter(s) for each style of high-intensity, gas-fired, radiant heater furnished.

1.7 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace components of radiant heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Period: All warranty periods listed below are from date of Substantial Completion.

a. Burner Assembly: Three years.
b. Combustion and Emitter Tubes: Three years.
c. Heater Controls: One year(s).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. CSA certified, with CSA Seal and certification number clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

B. UL listed and labeled, with UL label clearly visible on units indicating compliance with ANSI Z83.20/CSA 2.34.

C. 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.

2.2 DRAFT-INDUCED HEATERS

A. Description: Factory-assembled, indoor, overhead-mounted, electrically controlled, low-intensity, infrared radiant heating units using gas combustion. Heater to have all necessary factory-installed wiring and piping required prior to field installation and startup.

B. Fuel Type: Design burner for natural gas having characteristics same as those of gas available at Project site.

C. Burner Assembly:

1. Combustion-Air Inlet: Non-ducted, unvented.
2. Combustion-Air Inlet: Ducted horizontal to outdoors through sidewall with vent caps.
3. Combustion-Air Inlet: Ducted vertical to outdoors through roof with vent caps.
4. Burner Control Housing: Stainless steel.

    a. Totally enclosed with stainless-steel access cover.
    b. Sight glass for visual inspection of burner.
    c. Finish: Powder-coated finish.

5. Burner: Stainless steel.
6. Ignition System: Direct spark 24/25-V ac with flame rod sensing capabilities and self-diagnostic control module.
7. Combustion Blower Fan: Dynamically balanced, direct-driven, forward-curved fan with stainless-steel impeller and aluminized-steel housing, with a minimum temperature rating of 450 deg F (232 deg C).
8. Motor: Resilient-mounted, capacitor-start-capacitor-run type with sealed ball bearings; totally enclosed, nonventilated type with internal thermal protection.

D. Combustion Chamber: 4-inch- (100-mm-) diameter, 16-gage, aluminized-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Chambers shall be equipped with sight glass for burner and pilot flame observation.

E. Emitter Tube: 4-inch- (100-mm-) diameter, 16-gage, aluminized-steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish. Emitter tubing shall be equipped with baffles to maximize heating efficiency.

1. Tubing Connections: Stainless-steel threaded couplings.
2. 180-degree-bend emitter steel tubing with high-emissivity, high-temperature, corrosion-resistant external finish.

F. Vacuum Exhaust Fan: Dynamically balanced, direct-driven, cast-aluminum-alloy impeller in aluminized-steel housing, isolated from emitter tubing exhaust system by high-temperature flexible vibration isolation connector. Fan and connector to have a minimum temperature rating of 450 deg F (232 deg C).

G. Reflector: Polished aluminum, with end caps. Shape to control radiation from tubing for uniform intensity at floor level with 100 percent cutoff above centerline of tubing. Reflectors or entire heater shall accommodate rotational adjustment from horizontal to a minimum 30-degree tilt from vertical.

H. Accessories:

1. Reflector Extension Shields: Same material as reflectors, arranged for fixed connection to lower reflector lip and rigid support to provide 100 percent cutoff of direct radiation from tubing at angles greater than 30 degrees from vertical.
2. Protective grilles mounted to reflectors to protect emitter tubing.
3. Stainless-steel flexible connector with manual valve for gas supply.
4. Hanger chain with "S" hooks.
5. 3/16-inch- (5-mm-) diameter, aluminized-steel wire tubing hangers and reflector supports.
6. Rigid mounting kits.
7. Clearance warning plaque.

I. Capacities and Characteristics: As scheduled.

2.3 CONTROLS AND SAFETIES

A. Gas Control Valve: Single-stage, regulated redundant 24-V ac gas valve that contains pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.

B. Failure Safeguards: 100 percent shutoff of gas flow in the event of flame or power failure.

C. Prepurge of 30 seconds of air control system prior to burner ignition.

D. Safety lockout of burner after three consecutive ignition failures.

E. Blocked Vent Safety: Differential pressure switch in burner safety circuit to stop burner operation with high discharge or suction pressure.

F. Control Panel Interlock: Stops burner if panel is open.

G. Indicator Lights: "Airflow-on" and "burner-on" indicator lights.

H. Thermostat: Single-stage, wall-mounted type with 50 to 90 deg F (10 to 32 deg C) operating range and fan on switch.

1. Control Transformer: Integrally mounted.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structures, substrates, areas and conditions, with Installer present, for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance of the Work.

B. Examine roughing-in for fuel-gas piping to verify actual locations of piping connections before equipment installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Installation: Install gas-fired, radiant heaters and associated gas features and systems according to NFPA 54.

B. Suspended Units: Suspend from substrate using chain hanger kits and building attachments or mount to substrate using manufacturer's rigid mounting kits or custom fabricated brackets.

C. Maintain manufacturers' recommended clearances for combustibles.

3.3 CONNECTIONS

A. Gas Connections: Connect gas piping to radiant heaters according to NFPA 54.

B. Where installing piping adjacent to gas-fired, radiant heaters, allow space for service and maintenance.

C. Install electrical devices furnished with heaters but not specified to be factory mounted.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
2. Verify bearing lubrication.
3. Verify proper motor rotation.
4. Test Reports: Prepare a written report to record the following:

    a. Test procedures used.
    b. Test results that comply with requirements.
    c. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

C. Gas-fired, radiant heaters will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust initial-temperature set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

END OF SECTION 15731

SECTION 15732 - PROPELLER UNIT HEATERS

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.

1.2 SUMMARY

A. Section includes propeller unit heaters with electric-resistance heating coils.

1.3 DEFINITIONS

A. PTFE: Polytetrafluoroethylene plastic.

B. TFE: Tetrafluoroethylene plastic.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include location and size of each field connection.
4. Include details of anchorages and attachments to structure and to supported equipment.
5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
6. Indicate location and arrangement of integral controls.
7. Wiring Diagrams: Power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural members to which propeller unit heaters will be attached.
3. Method of attaching hangers to building structure.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For propeller unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 DESCRIPTION

A. Assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers.

B. 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.

C. Comply with UL 2021.

D. Comply with UL 823.

2.2 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.3 HOUSINGS

A. Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heaters before shipping.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.

2.4 COILS

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in steel or corrosion-resistant metallic sheath with fins no closer than 0.16 inch (4 mm). Element ends shall be enclosed in terminal box. Fin surface temperature shall not exceed 550 deg F (288 deg C) at any point during normal operation.

1. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
2. Wiring Terminations: Stainless-steel or corrosion-resistant material.

2.5 FAN AND MOTOR

A. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 15006 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Control Devices:

1. Wall-mounted, fan-speed switch.
2. Wall-mounted thermostat.

2.7 CAPACITIES AND CHARACTERISTICS: As scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive propeller unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install propeller unit heaters to comply with NFPA 90A.

B. Install propeller unit heaters level and plumb.

C. Suspend propeller unit heaters from structure with all-thread hanger rods and spring hangers with vertical-limit stop. Hanger rods and attachments to structure are specified in Section 15061 "Hangers and Supports for HVAC Piping and Equipment."

D. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

3.3 FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

B. Units will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust initial temperature set points.

B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain propeller unit heaters.

END OF SECTION 15732

SECTION 15741 - WATER-SOURCE UNITARY HEAT PUMPS

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.

1.2 SUMMARY

A. Section includes unitary heat pumps with refrigerant-to-water heat exchangers, refrigeration circuits, and refrigerant compressor(s).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each water-source unitary heat pump.
2. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of water-source unitary heat pump, signed by product manufacturer.

B. Field quality-control reports.

C. Sample Warranty: For manufacturer's warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For water-source unitary heat pumps to include in emergency, operation, and maintenance manuals.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of water-source unitary heat pumps that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, refrigeration components.
2. Warranty Period: Four years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance:

1. ASHRAE 15.

B. Comply with NFPA 70.

C. Comply with safety requirements in UL 484 for assembly of free-delivery, water-source heat pumps.

2.2 WATER-SOURCE UNITARY HEAT PUMPS, 6 TONS (21 kW) AND SMALLER

A. Description: Packaged water-source unitary heat pump with temperature controls; factory assembled, piped, wired, tested, and rated according to ASHRAE/ARI/ISO-13256-1.

1. 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. Cabinet and Chassis: Galvanized-steel casing with the following features:

1. Access panel for access and maintenance of internal components.
2. Knockouts for electrical and piping connections.
3. Cabinet Insulation: Glass-fiber liner, minimum 1/2 inch (13 mm) thick, complying with UL 181, ASTM C 1071, and ASTM G 21.

C. Water Circuits:

1. Refrigerant-to-Water Heat Exchangers:

a. Source-side coaxial heat exchangers with cupronickel water tube, with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig (3102 kPa) on refrigerant side and 400 psig (2758 kPa) on water side.
b. Load-side coaxial heat exchangers with cupronickel water tube, with enhanced heat-transfer surfaces inside a steel shell; both shell and tube are leak tested to 450 psig (3102 kPa) on refrigerant side and 400 psig (2758 kPa) on water side.

D. Refrigerant Circuit Components:

1. Sealed Refrigerant Circuit: Charge with R-410A refrigerant.
2. Filter-Dryer: Factory installed to clean and dehydrate the refrigerant circuit.

3. Charging Connections: Service fittings on suction and liquid for charging and testing on each circuit.
4. Reversing Valve: Four-way, solenoid-activated valve designed to be fail-safe in heating position with replaceable magnetic coil.
5. Compressor:

    a. Scroll.
    b. Single stage.
    c. Installed on vibration isolators and mounted on a structural steel base plate and full-length channel stiffeners.
    d. Exterior of compressor shall be wrapped with a high-density sound-attenuating blanket and housed in an acoustically treated enclosure.
    e. Factory-Installed Safeties:

        1) Antirecycle timer.
        2) High-pressure cutout.
        3) Low-pressure cutout or loss of charge switch.
        4) Internal thermal-overload protection.
        5) Freezestat to stop compressor if water-loop temperature in refrigerant-to-water heat exchanger falls below 35 deg F (2 deg C).
        6) Water-coil, low-temperature switch.

6. Refrigerant Piping Materials: ASTM B 743 copper tube with wrought-copper fittings and brazed joints.
7. Pipe Insulation: Refrigerant minimum 3/8-inch- (10-mm-) thick, flexible elastomeric insulation on piping exposed to airflow through the unit. Maximum 25/50 flame-spread/smoke-developed indexes according to ASTM E 84.
8. Refrigerant Metering Device: Thermal-expansion valve.

E. Controls:

1. Basic Unit Control Modes and Devices:

    a. Unit shutdown on high or low refrigerant pressures.
    b. Unit shutdown on low water temperature.
    c. Low- and high-voltage protection.
    d. Overcurrent protection for compressor.
    e. Random time delay, three to 10 seconds, start on power-up.
    f. Time delay override for servicing.
    g. Control voltage transformer.
    h. Water-coil freeze protection (selectable for water or antifreeze).
    i. Automatic intelligent reset. Unit shall automatically reset five minutes after trip if the fault has cleared. Should a fault reoccur three times sequentially, lockout requiring manual reset occurs.
    j. Ability to defeat time delays for servicing.
    k. Digital display to indicate high pressure, low pressure, low voltage, and high voltage.
    l. The low-pressure switch shall not be monitored for the first 90 seconds after a compressor start command to prevent nuisance safety trips.
    m. Remote fault-type indication at thermostat.
    n. Selectable 24-V dc or pilot duty dry contact alarm output.
    o. 24-V dc output to cycle a motorized water valve with compressor contactor.
    p. Service test mode for troubleshooting and service.
    q. Unit-performance sentinel warns when heat pump is running inefficiently.
    r. Compressor soft start.

2. Thermostat:

   a. Wall-Mounted Thermostat:

      1) Heat-cool-off switch.
      2) Seven days, programmable.
      3) Automatic changeover.
      4) Exposed temperature set point.
      5) Exposed temperature indication.
      6) Deg F indication.

   b. Wall-mounted temperature sensor.
   c. Duct-mounted temperature sensor
   d. Unoccupied period override push button.
   e. Digital display to indicate fault condition at heat pump.
   f. Data entry and access port.

      1) Input data include room temperature and humidity set points for occupied and unoccupied periods.
      2) Output data include room temperature and humidity, supply-air temperature, entering-water temperature, operating mode, and status.

3. Terminal Controller:

   a. “Aurora UPC” control board.

   b. Scheduled operation for occupied and unoccupied periods on seven-day clock with minimum of four programmable periods per day.
   c. Two-hour unoccupied override period.
   d. Remote-control panel to contain programmable timer and digital display for fault condition.
   e. Compressor-disable relay to stop compressor operation for demand limiting or switch to unoccupied operation.
   f. Automatic restart after five minutes if fault clears. Lockout after three attempts to restart following fault. Indicate fault for service technician.
   g. Backup for volatile memory.

   h. Interface relay for scheduled operation.
   i. Interface relay to provide indication of fault at central workstation.
   j. Provide Lonworks interface for central DDC workstation for the following functions:

      1) Set-point adjustment.
      2) Start/stop and operating status of heat-pump unit.
      3) Data inquiry to include supply-air and room-air temperature and humidity and entering-water temperature.
      4) Occupied and unoccupied schedules.

F. Electrical Connection: Single electrical connection fused disconnect.

G. Capacities and Characteristics: As scheduled.

2.3 ACCESSORIES

A. Hose Kits: Tag hose kits to equipment designations.

1. Minimum Working Pressure: 400 psig (2758 kPa).
2. Operating Temperatures: From 33 to 211 deg F (1 to 100 deg C).
3. Hose Length: 36 inches (900 mm).
4. Minimum Hose Diameter: Equal to water-source unitary heat-pump piping connection.
5. Hose Material: Braided stainless steel with adapters for pipe connections.
6. Isolation Valves: Two-piece, bronze-body ball valves with stainless-steel ball and stem, standard-port threaded connections, and galvanized-steel lever handle. Valves shall be factory installed on supply and return connections of both load-side and source-side heat exchangers. If balancing valve is combination shutoff type with memory stop, the isolation valve may be omitted on the return.
7. Strainer: Y-pattern with blowdown valve in supply connections of both load and source side of heat exchangers.
8. Balancing Valves: Mount in return connection. Include meter ports to allow flow measurement with differential pressure gage.

    a. Automatic balancing valve, factory set to operate within 10 percent of design flow rate over a pressure range of 2 to 80 psig (13.8 to 552 kPa).
    b. Manual, calibrated-orifice balancing valve with memory stop.
    c. Manual, venturi-type balancing valve with memory stop.

9. Water-Regulating Valve Assemblies: A direct acting valve regulates discharge pressure during the cooling cycle, and a reverse acting valve regulates the suction pressure during the heating cycle. Valves shall close when heat-pump compressor is not running.
10. Motorized Water Valve: Stop water flow through the unit when compressor is off. Slow-acting, 24-V dc valve with threaded connections is installed between isolation valves and heat exchanger.

B. Loop Controller: Six stages; two stages for heating and four stages for cooling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine 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 piping and electric installations for water-source unitary heat pumps to verify actual locations of piping connections and electrical conduits before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Equipment Mounting:

1. Install water-source, unitary heat pumps on cast-in-place concrete equipment base(s). Retain first paragraph below if units are suspended from structure.

B. Suspend water-source, unitary heat pumps from structure with all-thread hanger rods and spring hangers with vertical-limit stop.

C. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls.

3.3 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Connect supply and return hydronic piping to heat pump with hose kits.

B. Install electrical devices furnished by manufacturer but not specified to be factory mounted.

C. Install piping adjacent to machine to allow space for service and maintenance.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform the following field tests and inspections:

1. After installing water to water heat pumps and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Heat pumps will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect for visible damage to unit casing.
3. Inspect for visible damage to compressor and coils.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Adjust vibration isolators.
9. Start unit according to manufacturer's written instructions.
10. Complete startup sheets and attach copy with Contractor's startup report.
11. Inspect and record performance of interlocks and protective devices; verify sequences.
12. Operate unit for an initial period as recommended or required by manufacturer.
13. Verify thermostat calibration.
14. Inspect controls for correct sequencing of heating, refrigeration, and normal and emergency shutdown.

3.6 ADJUSTING

A. Adjust initial temperature set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 15741

SECTION 15810 - METAL DUCTS

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.

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.

6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment**,** and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinkler heads and main runs.
    e. Access panels.

1.6 QUALITY ASSURANCE

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

B. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials

involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 DUCT LINER – NOT ALLOWED

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width: 3 inches (76 mm).
3. Sealant: Modified styrene acrylic.
4. Water resistant.
5. Mold and mildew resistant.
6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
7. Service: Indoor and outdoor.
8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.

8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
9. Service: Indoor or outdoor.
10. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for10-inch wg (2500-Pa) static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 15820 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

D. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
3. Unconditioned Space, Exhaust Ducts: Seal Class C.
4. Unconditioned Space, Return-Air Ducts: Seal Class B.
5. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
6. Conditioned Space, Exhaust Ducts: Seal Class B.
7. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet (5 m).

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 15820 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer.

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
2. Test the following systems:
    a. Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, totaling no less than 100 percent of total installed duct area for each designated pressure class.
    b. Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, totaling no less than 100 percent of total installed duct area for each designated pressure class.
    c. Exhaust Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, totaling no less than 100 percent of total installed duct area for each designated pressure class.
    d. Outdoor Air Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections, totaling no less than 100 percent of total installed duct area for each designated pressure class.
3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
4. Test for leaks before applying external insulation.
5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
6. Give seven days' advance notice for testing.

C. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.
2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."

    a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.

D. Prepare test and inspection reports.

3.8 DUCT CLEANING

A. Clean new duct system(s) before testing, adjusting, and balancing.

B. Use service openings for entry and inspection.

1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
3. Remove and reinstall ceiling to gain access during the cleaning process.

C. Particulate Collection and Odor Control:

1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.

D. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

E. Mechanical Cleaning Methodology:

1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
5. Provide drainage and cleanup for wash-down procedures.
6. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.9 START UP

A. Air Balance: Comply with requirements in Section 15950 "Testing, Adjusting, and Balancing for HVAC."

3.10 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

B. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive 2-inch wg (500 Pa).
b. SMACNA Leakage Class for Rectangular: 12.
c. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

C. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg (250 Pa).
b. SMACNA Leakage Class for Rectangular: 12.
c. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg (500 Pa).
b. Minimum SMACNA Seal Class: B.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg (250 Pa).
b. Minimum SMACNA Seal Class: B.

c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

F. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm (5 m/s) or Lower:

1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
2) Mitered Type RE 4 without vanes.

b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm (7.6 m/s) or Higher:

1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
4) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.

H. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 15810

SECTION 15820 - AIR DUCT ACCESSORIES

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.

1.2 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Flange connectors.
5. Turning vanes.
6. Duct-mounted access doors.
7. Flexible connectors.
8. Duct accessory hardware.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:

a. Special fittings.
b. Manual volume damper installations.
c. Control-damper installations.
d. Duct security bars.
e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90 (Z275).
2. Exposed-Surface Finish: Mill phosphatized.

B. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.

C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

D. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Description: Gravity balanced.

B. Maximum Air Velocity: 1250 fpm (6.4 m/s).

C. Maximum System Pressure: 2-inch wg (0.5 kPa).

D. Frame: Hat-shaped, 0.05-inch- (1.3-mm-) thick, galvanized sheet steel, with welded corners or mechanically attached and mounting flange.

E. Blades: Multiple single-piece blades, center pivoted**,** maximum 6-inch (150-mm) width, 0.025-inch- (0.6-mm-) thick, roll-formed aluminum or 0.050-inch- (1.2-mm-) thick aluminum sheet with sealed edges.

F. Blade Action: Parallel.

G. Blade Seals: Extruded vinyl, mechanically locked.

H. Blade Axles:

1. Material: Plated steel or Stainless steel.
2. Diameter: 0.25 inch (5 mm).

I. Tie Bars and Brackets: Galvanized steel.

J. Return Spring: Adjustable tension.

K. Bearings: Synthetic pivot bushings.

L. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Chain pulls.
5. Screen Mounting: Front mounted in sleeve.
    a. Sleeve Thickness: 20 gage (1.0 mm) minimum.
    b. Sleeve Length: 6 inches (152 mm) minimum.
6. Screen Mounting: Rear mounted.
7. Screen Material: Aluminum.
8. Screen Type: Insect.
9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:
1. Standard leakage rating.
2. Suitable for horizontal or vertical applications.
3. Frames:
    a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.
4. Blades:
    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
5. Blade Axles: Stainless steel.

6. Bearings:

   a. Oil-impregnated bronze.
   b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

7. Tie Bars and Brackets: Galvanized steel.

2.5 CONTROL DAMPERS

A. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.

B. Frames:

1. Hat shaped.
2. 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
3. Mitered and welded or Interlocking, gusseted corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches (152 mm).
2. Parallel- and opposed-blade design.
3. Aluminum.
4. 0.0747-inch- (1.9-mm-) thick dual skin.
5. Blade Edging: Closed-cell neoprene.

D. Blade Axles: 1/2-inch- (13-mm-) diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F (minus 40 to plus 93 deg C).

E. Bearings:

1. Oil-impregnated stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
3. Thrust bearings at each end of every blade.

2.6 FLANGE CONNECTORS

A. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

B. Material: Galvanized steel.

C. Gage and Shape: Match connecting ductwork.

2.7 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

D. Vane Construction: Single wall.

2.8 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches (460 mm) Square: Continuous and two sash locks.

2.9 DUCT ACCESS PANEL ASSEMBLIES

A. Labeled according to UL 1978 by an NRTL.

B. Panel and Frame: Minimum thickness 0.0528-inch (1.3-mm) carbon steel.

C. Fasteners: Carbon steel. Panel fasteners shall not penetrate duct wall.

D. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F (1093 deg C).

E. Minimum Pressure Rating: 10-inch wg (2500 Pa), positive or negative.

2.10 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) or 5-3/4 inches (146 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

E. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression, and with a load stop. Include rod and angle-iron brackets for attaching to fan discharge and duct.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outdoor Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

2.11 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Compliance with ASHRAE/IESNA 90.1-2004 includes Section 6.4.3.3.3 - "Shutoff Damper Controls," restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft and control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

E. Set dampers to fully open position before testing, adjusting and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot (15-m) spacing.
8. Upstream from turning vanes.
9. Control devices requiring inspection.
10. Elsewhere as indicated.

H. Install access doors with swing against duct static pressure.

I. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).

J. Label access doors to indicate the purpose of access door.

K. Install flexible connectors to connect ducts to equipment.

L. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.

M. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.

N. Connect flexible ducts to metal ducts with liquid adhesive plus tape and draw bands.

O. Install duct test holes where required for testing and balancing purposes.

P. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 15820

SECTION 15830 - DIESEL VEHICLE EXHAUST SYSTEM

PART 1 - GENERAL

1.1 EXTRACTION SYSTEM OVERVIEW

A. The exhaust system shall be designed to vent 100 % of exhaust gases and particulate safely to the outside of the fire station. The exhaust system shall be designed and installed by factory-authorized personnel, which have been certified by the manufacturer of the exhaust system. Manufacturers shall be required to have a minimum of five years of proven manufacturing experience in the manufacture of emergency vehicle exhaust extraction equipment. This experience must include a vehicle (or) vehicles that have made 1200 emergency response calls a year for a minimum of 3 years. The purpose of this section of the specification insures that the vendor has a proven system for durability in high run departments.

B. This specified requirement allows the fire department to use the exhaust system for checking the vehicle pump and engine when it is inconvenient to do so outside the station house and without creating unnecessary performance criteria

C. System Description: The exhaust system shall be a source capture system designed to handle a minimum of (Qty.) vehicles in the bay area. All bays shall be designed for back in operation. A fan must have capability 600 CFM per drop.

D. System shall be an All-American Made Product

1.2 AIRFLOW REQUIREMENTS

A. Exhaust system shall be designed to eliminate vehicle exhaust gases by creating a negative pressure vacuum from vehicle tailpipe to the inlet of the fan. The exhaust fan shall provide a minimum of 600 cfm at 6.0 inches static pressure loss. Motor/ Blower curve information from the manufacturer must be provided with the bid document showing air handling capacity at various static pressure losses.

B. This exhaust system shall extract hot exhaust gases by creating a vacuum around entire exhaust tailpipe to draw the exhaust gases and particulate into the connection nozzle and induce cooler, ambient air at the universal nozzle and tailpipe adapter connection.

C. The system shall be designed to vent toxic exhaust gases when the exhaust fan is not powered up at engine start-up due to power failure by means of one-way ambient airflow tailpipe adapter that employs a high temperature silicone check valve at the nozzle connection to seal off the backwash of toxic exhaust gases when vehicle is connected to the exhaust extraction system

D. 100% sealed exhaust extraction systems must employ ambient air induction to cool hot gases down to save the life of the flexible hose and exhaust fan motor bearings.

E. Exhaust system hose drops shall be the same cross-sectional diameter as the vehicle tailpipe or greater. Also, exhaust system shall maintain CFM that matches the cfm of the vehicle engine exhaust when running at 1500 RPM. Hose drops that do not match the size of the tailpipe and the cfm of the engine’s exhaust shall not be accepted.

F. The purpose of this portion of the specification is to ensure that the exhaust system is designed to cool down hot exhaust gases as they are conveyed to the outside of the fire station. This type of exhaust extraction keeps exhaust temperatures within a safe limit to ensure that flexible hoses are within their designed temperature tolerances. Exhaust systems that size exhaust drops without dilution ventilation and also down size the exhaust connection hose unnecessarily put our vehicle engine warranty at risk.

1.3 OVERALL SYSTEM PERFORMANCE

A. System must be designed solely for high temperature vehicle exhaust fire rescue applications. The system shall automatically activate, disconnect, shutdown, and reactivate during an emergency situation without human operation

1.4 SYSTEM WARRANTY

A. Complete exhaust system warranty shall be for a minimum of 2 years.

B. Any vendor claim of proven long-term durability must be illustrated on the specific product mentioned in this specification.

C. Any System offered to the city, that adds new or nonstandard system components not normally a part of the standard design used in all other emergency vehicle response application to date, shall not be accepted.

1.5 TURNKEY INSTALLATION

A. Complete exhaust system including the exhaust fan, control box, ductwork, and extraction unit shall be proven, and field tested for a minimum of 5 years in the United States of America.

B. All system components shall be labeled with manufacturer identification.

C. Installation of Exhaust System shall be accomplished by a factory authorized installation team that specializes in the business of installing emergency response exhaust systems. Installations must be performed by installers that have been trained and certified by manufacturer.

1.6 AIR TESTING

A. The overall design shall include individual systems for each apparatus that are specifically designed for the output CFM of the apparatus engine.

B. The design CFM for each vehicle shall be a minimum 600 CFM.

C. The designed CFM stated has been selected to ensure that exhaust system will not restrict airflow of exhaust gases as they are ducted to the outside of the station.

D. Air balancing shall be performed to ensure that the designed CFM requirements are met for each bay.

1.7 FINAL ACCEPTANCE

A. At conclusion of installation of exhaust system all vehicles in the facility will be operated for a period of 15 minutes to ensure that extraction hose, ducting, and fan have been sufficiently sized for all the vehicles operating in the fire station by providing negative pressure from the connection nozzle to the exhaust fan.

2.1 METHOD OF NOZZLE ATTACHMENT

A. The exhaust system shall be attached to the vehicle within 3 feet of the door threshold.

B. The system shall be designed so that attachment to exhaust hose is accomplished by the operator standing erect and with one simple motion connect system to vehicle.

2.2 METHOD OF NOZZLE RELEASE

A. The disconnection of the hose shall not be speed dependent and have a balancer that lifts the exhaust nozzle off the vehicle tailpipe. The nozzle must separate from the tailpipe at the same point each time regardless of the speed of the vehicle.

B. Any auto-release system that is speed sensitive requiring the driver to modify the exit speed to control the nozzle release, shall not be accepted. Any nozzle requiring support systems, such as compressed air or electrical support to operate or release shall not be accepted.

C. The intent of this portion of the specification is to reduce the amount of exhaust gases that will backwash into the station house due to early release of vehicle tailpipe or reduce the risk of violent or non-release if the driver outruns a trip mechanism.

D. The major benefit of this portion of the specification is to extend the life of the exhaust hose due to less stress at release of vehicle tailpipe.

3.1 EXTRACTION SYSTEM MOUNTING METHODOLOGY

A. System track must be supported a minimum of every 10 ft and no more than 5 feet of track shall be cantilevered from the end of the first and last support. A minimum of 2 supports shall be required for track systems that are 20 feet in length. Systems that are longer than 20 feet long must have at least 1 support every 10 feet.

B. The exhaust system shall be suspended from the building structure by means of aluminum vertical supports with galvanized strut attached to the building structure that is designed to eliminate side to side and front and back sway of exhaust system track or rail profile. The forces that are calculated must correspond with the release method of the exhaust system.

C. Overall look of suspension system must match the station quarters in a way that will benefit the appearance of the facility. All vendors must carefully examine the station house and publish their method of supporting the exhaust system which includes maneuvering around bay doors.

3.2 SLIDING ALUMINUM TRACK - Not Required.

4.1 THE SYSTEM BALANCER

A. The hose balancer shall be non-locking and latching so that the connection of the exhaust system to the vehicle tailpipe is made simpler and easier for emergency personnel.

B. System balancer shall be calibrated and certified to carry the hose weight and have the capability to pull nozzle off the vehicle tailpipe by using a 0.80 stainless steel aircraft cable no more than 40” in length.

C. The purpose of this portion of the specification is to have a rugged specially designed system balancer peel the nozzle from the vehicle tailpipe.

5.1 EXTRACTION SYSTEM EXHAST HOSE

A. The flexible exhaust hose is manufactured for the sole purpose of venting high temperature exhaust gases which are produced by internal combustion engines.

B. Flexible Hose Shall be high temperature synthetic rubber impregnated into a high temperature laminated fabric with Helix wire spacing equaling 3/4" apart, continuing throughout the entire

hose, with a minimum thickness of Helix wire equaling 0.080, and including a minimum overlapping thickness of 2 7/16".

C. This construction of hose must be capable of operating at a continuous temperature of 400°F and intermittent temperatures of 500°F. Lower 2' X 5" diameter hose shall be stiffer in construction and rated at 850 degrees. The stiffer hose construction and loading handle allow for the personnel to attach the nozzle to the tailpipe adapter in a standing position (no bending over the tailpipe). The 850-degree hose tolerance allows for higher exhaust temperature that the hose may be subject to during the operating times.

D. The exhaust hose diameter shall be a minimum of 5 inches depending on the size of the vehicle engine and corresponding exhaust pipe diameter. Hoses that are 4 inches in diameter will not be tolerated. Hose diameters of 5 inches and greater lessen internal air stream temperature and friction loss within the system which allows for greater air delivery by the fan.

E. Hoses shall be individually sized for each bay depending on the types of vehicles that are to be used in the bay that the Exhaust system is installed. The exhaust hose shall not have any pieced together connections so as to avoid diesel exhaust leakage.

F. Any exhaust system that relies on static regain from the vehicle engine or uses the engine horsepower to push the hot exhaust gases into the exhaust system shall not be accepted. Any ventilation system design that allows for hose a diameter smaller than the vehicle tailpipe shall not be accepted.

G. The sole purpose of this requirement is to ensure that the exhaust hose that is used for this application is rightly applied to the purpose of venting hot exhaust gases directly to the outside of the station house. This benefits the department by extending the life of the exhaust hose which is affected the most in source capture systems

6.1 UNIVERSAL NOZZLE

A. Engineered and specially designed exhaust system nozzle (female connection) that is specifically designed to fit tightly over the circumference of an engineered mating ring (male connection) that attaches to the tail pipe and attaches tightly around the ring to capture 100% of the carcinogenic diesel exhaust fumes.

B. Incorporated in the rubber boot are 4 to 8 powerful rare earth magnets which are strategically located inside two sets of metal pole pieces that pivot in and out to allow for smooth release of vehicle tailpipe.

C. This allows smooth positioning of the nozzle over the mating ring to produce a required substantially air tight seal, eliminating backwash of diesel exhaust fumes into the station.

D. The release of the nozzle shall be activated by a forward motion of an apparatus simultaneously causing a lifting and backward motion of the release nozzle. This action shall institute a simple mechanical release. The simple release shall be based solely on the upward pull of the system balancer, which causes the pole pieces to pivot on the tailpipe radius and release over the flared end of the tailpipe.

7.1 ALUMINUM TRANSITION ELBOW ASSEMBLY

A. The nozzle shall be fitted to Cast Aluminum Elbow Transition, manufactured from 319 aluminum and incorporating a 62°-degree curved angle. A special rag screen channel cast into the elbow shall allow for easy installation of replaceable non-static preformed spring steel rag screen with black oxide finish. A large 7" inlet opening shall incorporate a 1" mounting flange with molded

locating pin for easy and accurate installation of rubber boot assembly. Aluminum elbow assembly shall be offered in all hose sizes, 4, 5 and 6 inches.

B. Removal spring wire rag screen must be preformed spring steel oxide treaded finish. Allows for easy removal.

8.1 TAILPIPE ADAPTER

A. Tailpipes that are connected to the system shall be retrofitted with a tailpipe adapter (male end). The tailpipe adapter allows the nozzle (female end) to fit tightly against the outer edge of the mating ring on tailpipe adapter.

B. The ring shall contain a series of machined 3/4" oval holes placed around the circumference of the ring which allows cool ambient air to enter into the exhaust hose reducing the temperature of the diesel exhaust, and thereby extending the life of the exhaust hose.

C. The circumference of the mating ring shall have a one-way silicon check valve rated at a minimum 600 degrees that opens or closes depending on the exhaust system airflow condition, when air pressure is either positive or negative. When the exhaust system is in a positive mode, the one-way check valve will press against the holes on the ring and close off the ambient air intake. This will prevent any backflow of diesel exhaust into the firehouse. When air pressure in the nozzle is negative, which is the normal condition, a silicone check valve will remain open and will prevent any harmful carcinogenic materials from back washing into the apparatus bay and/or filtering into the living areas as well as cool the exhaust temperatures. Ambient air introduction at the nozzle/tailpipe adaptor will also protect the apparatus engine from backward spinning of its turbo charger when the fan is activated by another vehicle engine startup located in the adjacent bay and that apparatus is not operational. This will occur because the fan will pull air from around the tailpipe connection rather than the vehicle engine compartment.

D. The tailpipe adaptor should incorporate 5 - 25-degree Stainless Steel turndown veins inside the 5-inch diameter circumference of the tailpipe to protect the public and public property as well as fire personnel from accidental burns or discoloration of property. This will be accomplished by directing the hot exhaust away from the fire fighter and downward 30 degrees toward the ground.

9.1 EXHAUST FAN OVERVIEW

A. The exhaust fan shall be sized for a minimum of 600 CFM per extraction. The induction of ambient air at the tailpipe connection shall insure that the exhaust temperature at the fan will less be then 150 degrees at the fan motor. Blower curve information for the motor/ blower combination being supplied MUST be included in the submittal information.

B. Each exhaust fan shall be designed specifically for the fire station with these factors being addressed:

1. The size and total number of vehicles being attached to exhaust fan.
2. The overall design of fire & emergency vehicle bays.
3. The location of the living quarters.
4. The existing electrical phase
5. The physical location of the fire station in the community that is served by the fire department (The sound level of the fan motor while in operation).

C. The exhaust fan shall be sized for a minimum of 600 CFM per extraction unit unless larger or smaller vehicles are being attached to exhaust system. The induction of ambient air at the tailpipe connection shall insure that the exhaust temperature at the fan will less be then 150 degrees at the fan motor.

D. The sound decibels generated by the fan motor and impeller shall not exceed 81 Db at 5 feet. A silencer is recommended for applications greater than this to further lessen noise levels.

E. No motor that allows exhaust temperatures in excess of 200 degrees shall be accepted, this requirement insures long life the exhaust fan motor and bearings.

F. Pump Checks Option: System shall allow for pump checks to be conducted indoors. System shall allow for pump checks to be conducted for 15 minutes or more without damage to the system. Exhaust fan system shall provide negative pressure from system nozzle connection to exhaust fan inlet ductwork.

9.2 FAN AIRFLOW CRRITERIA

A. Shall be designed as a pre-engineered exhaust fan designed for the sole purpose of exhausting Volatile Organic Compound (VOC) and carcinogenic compounds generated by internal combustion engines designed to propel any motor vehicle.

B. The exhaust fan should operate automatically only during the point of when electrical power is administered to the totally enclosed fan motor.

C. Blower wheel design shall be backward inclined with minimum horsepower motor to produce the desired results for optimum efficiency and long-term viability. Operating static pressure to be 6” water column.

D. Fan shall be capable of delivering a minimum of 600 CFM per vehicle at 6” negative static pressure for 5” diameter hose drops.

E. Fan will not be designed with static regain from vehicle engine to assist in meeting the performance criteria mentioned in next paragraph. At no point shall the diameter of the hose drop be less then diameter of vehicle tailpipe.

9.3 PHYSICAL FAN DATA

A. Fan housing shall be heavy gauge welded steel construction suitable for temperatures up to 250 degrees. Housings shall be provided with drilled inlet and discharge flanges. The discharge flange shall be “full flange” design.

B. The housing frame shall be constructed with four flat sides to allow for discharge change to vertical or horizontal positions with disassembly of unit.

C. Fan Impeller blower wheel shall be backward curved single thickness aluminum blade design.

D. Welds on fan housing shall be performed by a factory qualified personnel who have met the requirements of ASME Section IX.

E. The first resonant speed of each rotor shall be not less than 125 percent of normal operating.

F. Rotor shall be two plane dynamically balanced to a maximum final vibration level of 1.0 mil.

G. Fan Motor shall be UL listed and manufactured by a readily available nationally recognized motor manufacturer. Motor shall be a permanently sealed and lubricated motor. Motor shall be supplied as a totally enclosed fan cooled or non-ventilated type with a readily available NEMA frame from 56-145Tand designed for an application where standard use is intermittent starts on average of ten times per day.

H. Fan Motor base frame shall be constructed with four flat sides to allow for discharge to change from vertical or horizontal positions without disassembly of fan housing.

I. Motor bearings shall be heavy duty anti-friction, self-aligning ball or roller bearings with positive shaft locking.

J. Fan Motor Vibration Isolation shall be manufactured as a complete assembly to assure the least possible vibration or movement. Fan wheel shall be both statically and dynamically balanced.

K. Fan Motor Power shall be 3 phase whenever readily available in station. Single phase shall only be used when the cost of providing 3-phase power becomes prohibitive or when adequate supply of usable breakers is not available or otherwise instructed by the city.

L. Fan Motor Labeling and Identification must bear the same manufacturers name as the primary exhaust ventilation equipment and electrical controller operating it. Also listed on labeling shall be model number, RPM, pressure, inlet size, outlet size, temperature limitations, Brake Horse Power (BHP), CFM, class, and any warning labels or instructions required by Underwriters laboratories (UL).

10.1 SYSTEM DUCTWORK

A. All galvanized ductwork shall be spiral G-90 galvanized pipe and shall be a minimum of 26-gage pipe sizes for 4” – 8” in diameter, 24-gage pipe for sizes 8.5” – 15” in diameter, and 22-gage pipe for sizes 16” – 22” in diameter.

B. Duct Seals on the connection shall be with 400-degree silicone. Brazing and welding at joints are not required because duct system is designed for 7” of negative pressure and at these pressures the silicone sealant is sufficient to seal the system. The lateral fittings shall be brazed or welded and must be designed with a minimum 45-degree branch taps for a smooth convergence of two or more airstreams.

C. If duct system is designed for more than 7” static pressure than welding, brazing, and additional mechanical seals shall be required for the sole purpose that ductwork is used as an extension of the exhaust pipe and at times is placed under positive pressure.

11.1 AUTO-START CONTROL SYSTEM

A. Shall be designed to sense the output pressure which is normally generated by any internal combustion engine designed to operate any gas or diesel engine. The operating logic must be designed to complete this cycle. When the nozzle is connected to the vehicle's exhaust tailpipe and the vehicle is started by the operator an automatic controller, senses the increased output pressure and energizes the exhaust fan. A low voltage timer will keep the exhaust fan operating for a period of time designated by fire department procedures.

. Electrical Controller must be UL listed/approved and manufactured in accordance with Underwriters Laboratories standard UL-508 for enclosed industrial control panels and incorporate a limited energy control circuit.

C. Controller enclosure must be NEMA 12 rated and UL listed as type 12. Fiberglass construction

D. System control unit mounted electrical enclosure to restrict access of internal components of controller by only authorized entry.

E. Electrical contractor shall be Allen Bradley industrial electrical contractor provided with the appropriate adjustable overload relays to meet the proper full load amperage of motor it is designed to control. Contactor must conform to the following standards: BS-5424, VDE0660, and approved by UL certification as an approved component.

F. Controller transformer to be UL listed industrial control circuit transformer with primary and secondary fuse blocks. Transformer must be provided with multi-tap primary 208V through 480V, AC, and 24V through 120V secondary.

G. Controller timer shall be solid state, 60.-min variable timer. Operating logic must complete this cycle. Input voltage is applied to the timer at all times. Upon closure of a normally open isolated start switch, the load energizes and remains energized as long as the switch is closed. When the start switch opens, the timing cycle starts. At the end of the present time delay, the load de-energizes and the timer is ready for a new timing cycle. Timer must be UL recognized component under file number E65038.

H. System pressure sensor must be engine pressure sensing type capable of recognizing the output pressure of any type of motor vehicle. Electrical contact must be dry type and not exceed 24V.

I. Stop/Start Switch located on exterior of Controller shall be a red illuminated contact button. This device must meet UL type 4X rating. Indicator light/start button must be mounted on the enclosure cover and be identified by engraved ledger plate.

J. Shall be provided and secured permanently to the exterior of electrical controller, indicating the manufacturer, their address and telephone number, user instructions and any warnings or cautions required by Underwriter Laboratories.

K. Controller Supplier will fully guarantee a minimum of two-year warranty on parts. Exceptions are obvious misuse and/or abuse to the system.

L. Shall be offered with optional Wireless low-voltage Sensor operation.

M. Shall be offered with optional Ignition Start wireless control from apparatus if required.

12.1 SUCTION RAIL

A. The suction rail system shall be comprised of Rail Sections which shall have aluminum top profile length of ten feet (10’). Material shall be 6063-T-5 with a standard mill finish.
B. The aluminum rail shall be constructed from a one-piece continuous extruded aluminum profile. Construction shall be 6” round in diameter, with guide rails on each side to accommodate the external trolley assembly, and a slotted profile in the top for leg and support bracing. Rail wall thickness shall be 0.150. An opening of 3” along the bottom of the rail, shall incorporate slots on each side to accept a pair of molded neoprene rubber seals. Seals shall be installed into the bottom of the rail, to seal the tube and prevent the escape of exhaust gases while being extracted. A vacuumed form ABS molded end cap, shall incorporate in its design, both an end cap feature and a hose connection.
C. The end cover will seal off the ends of the rail. The total weight of these rail sections shall be 6 lbs. per foot.
D. The system shall further have suspension attachments, which shall be placed a maximum of 10' apart, for the purpose of rail support, and will be mounted in pairs from roof beams or brackets.
E. Connection to a fan shall be by means of a direct connection, thru molded end cap or by fabricated sheet metal plenums. When plenums are used, connections are made on top or sides of the rail. The complete rail system shall provide means of exhaust extraction, for vehicles moving within a work area.

12.2 SUCTIONRAIL CRAB (TROLLEY) ASSEMBLY

A. The trolley assembly shall be of external guide rail design. The assembly shall be designed and constructed, using a tube frame assembly with removal outer side assemblies, and finished in a powder coated blue.
B. Four external Delron wheels, using oil less bearing design, shall insure long life and allow the trolley assembly to roll freely along the external guide rails outside of the dirty airstream. System

crabs or trolleys that incorporate wheels that roll inside the suction rail will not comply and will be rejected.

C. The chasse shall include a fitted cone assembly, designed to part the memory sealing lips. The cone assembly shall be designed with a series of friction rollers. These rollers shall be designed to reduce the resistance between the memory lips and the cone assembly.

D. The trolley shall be fitted with a front and rear rubber bumper, designed to eliminate metal-to-metal contact, which otherwise might cause damage to the assemblies.

12.3 CRAB INLET PLENUM

A. Plenum shall be designed and manufactured from 16-gauge CRS with a powder coated silver finish. A balancer attachment ring shall be fabricated in the center of plenum, to insure complete balance and weight distribution.

B. The attachment ring shall connect the balancer to the crab assembly. This design and feature will insure that the downward force exerted on the wheels shall be evenly distributed, to insure long life to the trolley assembly and produce the most efficient overall operating results. The plenum shall incorporate an isolation damper, insuring a positive fan startup.

13.1 ADJUSTABLE SHOCK ABSORBER END STOP ASSEMBLY

A. Shock absorber assembly shall incorporate an adjustable pneumatic cylinder, capable of reducing the forward impact of the trolley assembly, without causing damage to either the suction rail or the trolley assembly.

B. The assembly must be designed to have adjustable movement throughout the entire length of the rail. The assembly shall be designed to allow for a full stop of trolley (trolleys) in less than 6”.

C. A rubber bumper shall be located on the trolley assembly and designed as a contact point. The pneumatic cylinder shall be equipped with a rubber bumper end stop. Both bumpers shall be assigned to align upon impact, and at no time shall metal to metal or plastic to metal contact be allowed.

14.1 POINT OF ORIGIN

A. All American Made product - Equipment shall be manufactured by a U.S. Company that is headquartered in the United States of America. All components shall be American Standard. All standards of quality must be meet and adhered to including but not limited to: UL, NFPA, AMCA, IMC, ASME, UMC, NEC and all local and state building codes.

END OF SECTION 15830

SECTION 15840 - GAS VENTS

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.

1.2 SUMMARY

A. Section Includes:

1. Listed double-wall vents.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for product.

B. Shop Drawings: For vents.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

PART 2 - PRODUCTS

2.1 LISTED TYPE B AND BW VENTS

A. Description: Double-wall metal vents tested according to UL 441 and rated for 480 deg F (248 deg C) continuously for Type B or 550 deg F (288 deg C) continuously for Type BW; with neutral or negative flue pressure complying with NFPA 211.

B. Construction: Inner shell and outer jacket separated by at least a 1/4-inch (6-mm) airspace.

C. Inner Shell: ASTM B 209 (ASTM B 209M), Type 3003 aluminum.

D. Outer Jacket: Galvanized steel.

E. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
1. Termination: Exit cone with drain section incorporated into riser.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Listed Type B and BW Vents: Vents for certified gas appliances.

3.3 INSTALLATION OF LISTED VENTS

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

B. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.

C. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.

D. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.

E. Lap joints in direction of flow.

3.4 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

END OF SECTION 15840

SECTION 15901 - INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

B. Provide automatic temperature controls that include but are not limited the following parts and functions:

1. LonTALK controllers in all water source heat pumps that respond to a remote thermostat or alternately a LonTALK communicating thermostat serving each heat pump.

2. A LonTALK controller in the mechanical room that provide start-stop for the condenser water pumps, temperature sensing and reporting, pump status and other functions as described in the sequence of operation.

3. A twisted pair cable network, daisy chained to all LonTALK controllers and terminating where indicated on the System Architecture plan. The L-IP router and a computer are not included in the project at this time.

4. The factory furnished controllers shall generally conform to the requirements of this specification section.

1.2 ACTION SUBMITTALS

A. Product Data: For each control device indicated.

B. Shop Drawings:

1. Schematic flow diagrams.
2. Power, signal, and control wiring diagrams.
3. Details of control panel faces.
4. Damper schedule.
5. Valve schedule.
6. DDC System Hardware: Wiring diagrams, schematic floor plans, and schematic control diagrams.
7. Control System Software: Schematic diagrams, written descriptions, and points list.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

B. Software and firmware operational documentation.

1.5 QUALITY ASSURANCE

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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 CONTROL SYSTEM

A. Manufacturers:
   1. Andover Controls Corporation.
   2. Automated Logic Corporation.
   3. Honeywell International Inc.; Home & Building Control.
   4. Invensys Building Systems.
   5. Johnson Controls, Inc.; Controls Group.
   6. KMC Controls/Kreuter Manufacturing Company.
   7. Siemens Building Technologies, Inc.
   8. TAC Americas, INC.

B. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, and accessories to control mechanical systems.

C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

2.3 DDC EQUIPMENT

A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.

   1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation.
   2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.
d. Software applications, scheduling, and alarm processing.
e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.

1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
2. Stand-alone mode control functions operate regardless of network status. Functions include the following:

a. Global communications.
b. Discrete/digital, analog, and pulse I/O.
c. Monitoring, controlling, or addressing data points.

3. Local operator interface provides for download from or upload to operator workstation.

C. I/O Interface: Hardwired inputs and outputs may connect into system through controllers. Protect points so that shorting will cause no damage to controllers.

1. Binary Inputs: Allow monitoring of on-off signals without external power.
2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
7. Universal I/Os: Provide software selectable binary or analog outputs.

D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:

1. Output ripple of 5.0 mV maximum peak to peak.
2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.

E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:

1. Minimum dielectric strength of 1000 V.
2. Maximum response time of 10 nanoseconds.
3. Minimum transverse-mode noise attenuation of 65 dB.
4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.

1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform automatic system diagnostics; monitor system and report failures.
3. Enclosure: Dustproof rated for operation at 32 to 120 deg F (0 to 50 deg C).

2.5 ELECTRONIC SENSORS

A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.

B. Thermistor Temperature Sensors and Transmitters:

1. Manufacturers:

a. BEC Controls Corporation.
b. Ebtron, Inc.
c. Heat-Timer Corporation.
d. I.T.M. Instruments Inc.
e. MAMAC Systems, Inc.
f. RDF Corporation.

2. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
5. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Concealed.
b. Set-Point Indication: Concealed.
c. Thermometer: Concealed.
d. Orientation: Vertical.

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

C. RTDs and Transmitters:

1. Manufacturers:

a. BEC Controls Corporation.
b. MAMAC Systems, Inc.
c. RDF Corporation.

2. Accuracy: Plus or minus 0.2 percent at calibration point.
3. Wire: Twisted, shielded-pair cable.
4. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
5. Averaging Elements in Ducts: 18 inches (460 mm) long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft. (0.84 sq. m); length as required.
6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches (64 mm).
7. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Concealed.
b. Set-Point Indication: Concealed.
c. Thermometer: Concealed.
d. Orientation: Vertical.

8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
9. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.

D. Humidity Sensors: Bulk polymer sensor element.

1. Manufacturers:

a. BEC Controls Corporation.
b. General Eastern Instruments.
c. MAMAC Systems, Inc.
d. ROTRONIC Instrument Corp.
e. TCS/Basys Controls.
f. Vaisala.

2. Accuracy: 5 percent full range with linear output.
3. Room Sensor Range: 20 to 80 percent relative humidity.
4. Room Sensor Cover Construction: Manufacturer's standard locking covers.

a. Set-Point Adjustment: Concealed.
b. Set-Point Indication: Concealed.
c. Thermometer: Concealed.
d. Orientation: Vertical.

5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F (0 to 50 deg C).
7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.

E. Pressure Transmitters/Transducers:

1. Manufacturers:

a. BEC Controls Corporation.
b. General Eastern Instruments.
c. MAMAC Systems, Inc.
d. ROTRONIC Instrument Corp.
e. TCS/Basys Controls.
f. Vaisala.

2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.

a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
b. Output: 4 to 20 mA.
c. Building Static-Pressure Range: 0- to 0.25-inch wg (0 to 62 Pa).
d. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).

3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure; linear output 4 to 20 mA.
4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.

F. Room Sensor Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Concealed.
2. Set-Point Indication: Concealed.
3. Thermometer: Concealed.
4. Orientation: Vertical.

G. Room sensor accessories include the following:

1. Insulating Bases: For sensors located on exterior walls.
2. Adjusting Key: As required for calibration and cover screws.

2.6 STATUS SENSORS

A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).

B. Status Inputs for Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.

C. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.

D. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.

E. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.

F. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.

G. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

H. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

1. Manufacturers:

a. BEC Controls Corporation.
b. I.T.M. Instruments Inc.

2.7 GAS DETECTION EQUIPMENT

A. Manufacturers:
1. Ebtron, Inc.
2. Honeywell International Inc.; Home & Building Control.
3. Sensidyne, Inc.
4. TSI Incorporated.
5. Vaisala.

B. Carbon Monoxide Detectors: Single or multichannel, dual-level detectors using solid-state plug-in sensors with a 3-year minimum life; suitable over a temperature range of 32 to 104 deg F (0 to 40 deg C); with 2 factory-calibrated alarm levels at 35 and 200 ppm.

C. Carbon Dioxide Sensor and Transmitter: Single detectors using solid-state infrared sensors; suitable over a temperature range of 23 to 130 deg F (minus 5 to plus 55 deg C) and calibrated for 0 to 2 percent, with continuous or averaged reading, 4- to 20-mA output, for wall mounting.

2.8 THERMOSTATS

A. Electric, solid-state, microcomputer-based room thermostat with remote sensor, and LonTALK Communication connection.

1. Automatic switching from heating to cooling.
2. Preferential rate control to minimize overshoot and deviation from set point.
3. Set up for four separate temperatures per day.
4. Instant override of set point for continuous or timed period from 1 hour to 31 days.
5. Short-cycle protection.
6. Programming based on every day of week.
7. Selection features include degree F or degree C display, 12- or 24-hour clock, keyboard disable, remote sensor, and fan on-auto.
8. Battery replacement without program loss.
9. Thermostat display features include the following:

a. Time of day.

b. Actual room temperature.
c. Programmed temperature.
d. Programmed time.
e. Duration of timed override.
f. Day of week.
g. System mode indications include "heating," "off," "fan auto," and "fan on."

B. Low-Voltage, On-Off Thermostats: NEMA DC 3, 24-V, bimetal-operated, mercury-switch type, with adjustable or fixed anticipation heater, concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

C. Line-Voltage, On-Off Thermostats: Bimetal-actuated, open contact or bellows-actuated, enclosed, snap-switch or equivalent solid-state type, with heat anticipator; listed for electrical rating; with concealed set-point adjustment, 55 to 85 deg F (13 to 30 deg C) set-point range, and 2 deg F (1 deg C) maximum differential.

1. Electric Heating Thermostats: Equip with off position on dial wired to break ungrounded conductors.
2. Selector Switch: Integral, manual on-off-auto.

D. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.

1. Bulbs in water lines with separate wells of same material as bulb.
2. Bulbs in air ducts with flanges and shields.
3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.
6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.

E. Room Thermostat Cover Construction: Manufacturer's standard locking covers.

1. Set-Point Adjustment: Concealed.
2. Set-Point Indication: Concealed.
3. Thermometer: Concealed.
4. Orientation: Vertical.

F. Room thermostat accessories include the following:

1. Insulating Bases: For thermostats located on exterior walls.
2. Adjusting Key: As required for calibration and cover screws.
3. Set-Point Adjustment: 1/2-inch- (13-mm-) diameter, adjustment knob.

G. Immersion Thermostat: Remote-bulb or bimetal rod-and-tube type, proportioning action with adjustable throttling range and adjustable set point.

H. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.

I. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or below set point.

1. Bulb Length: Minimum 20 feet (6 m).
2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

J. Electric, High-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches (300 mm) of bulb length is equal to or above set point.

1. Bulb Length: Minimum 20 feet (6 m).
2. Quantity: One thermostat for every 20 sq. ft. (2 sq. m) of coil surface.

2.9 HUMIDISTATS

A. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.

2.10 ACTUATORS

A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
1. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
2. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
3. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).

B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.

1. Valves: Size for torque required for valve close off at maximum pump differential pressure.

2. Coupling: V-bolt and V-shaped, toothed cradle.
3. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
4. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
5. Power Requirements (Two-Position Spring Return): 24 or 120-V ac. Provide appropriate control power transformers.
6. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
7. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
8. Temperature Rating: Minus 22 to plus 122 deg F (Minus 30 to plus 50 deg C).
9. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).

2.11 CONTROL VALVES

A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

B. Hydronic system globe valves shall have the following characteristics:

1. NPS 2 (DN 50) and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with backseating capacity repackable under pressure.
2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.

    a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.

4. Sizing: 5-psig (35-kPa) maximum pressure drop at design flow rate or the following:

    a. Two Position: Line size.
    b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
    c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.

5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.

2.12 DAMPERS – As specified elsewhere.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 60 inches (1530 mm) above the floor.

1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.

B. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.

C. Install labels and nameplates to identify control components.

D. Install hydronic instrument wells, valves, and other accessories.

E. Install electronic and fiber-optic cables according to Division 27 Section "Communications

3.2 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
2. Test and adjust controls and safeties.
3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
4. Test each point through its full operating range to verify that safety and operating control set points are as required.
5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

END OF SECTION 15901

SECTION 15950 - TESTING, ADJUSTING AND BALANCING FOR HVAC

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.

1.2 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

    a. Constant-volume air systems.

2. Balancing Hydronic Piping Systems:

    a. Constant-flow hydronic systems.

3. Testing, Adjusting and Balancing Equipment:

    a. Heat exchangers.
    b. Motors.
    c. Heat-transfer coils.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. BAS: Building automation systems.

C. NEBB: National Environmental Balancing Bureau.

D. TAB: Testing, adjusting, and balancing.

E. TABB: Testing, Adjusting, and Balancing Bureau.

F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

A. TAB Conference: Conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.

1. Minimum Agenda Items:

    a. The Contract Documents examination report.
    b. The TAB plan.
    c. Needs for coordination and cooperation of trades and subcontractors.
    d. Proposed procedures for documentation and communication flow.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: Within 60 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.

B. Contract Documents Examination Report: Within 30 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.

C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

D. System Readiness Checklists: Within 30 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.

E. Examination Report: Submit a summary report of the examination review required in "Examination" Article.

F. Certified TAB reports.

G. Sample report forms.

H. Instrument calibration reports, to include the following:

1. Instrument type and make.
2. Serial number.
3. Application.
4. Dates of use.
5. Dates of calibration.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. TAB Specialists Qualifications: Certified by NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB or TABB.
2. TAB Technician: Employee of the TAB specialist and certified by NEBB or TABB as a TAB technician.

C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

K. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.

L. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

M. Examine system pumps to ensure absence of entrained air in the suction piping.

N. Examine operating safety interlocks and controls on HVAC equipment.

O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:

1. Equipment and systems to be tested.
2. Strategies and step-by-step procedures for balancing the systems.
3. Instrumentation to be used.
4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:

1. Airside:

a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
b. Duct systems are complete.
c. Volume, smoke, and fire dampers are open and functional.
d. Clean filters are installed.
e. Fans are operating, free of vibration, and rotating in correct direction.
f. Variable-frequency controllers' startup is complete, and safeties are verified.
g. Automatic temperature-control systems are operational.
h. Ceilings are installed.
i. Windows and doors are installed.
j. Suitable access to balancing devices and equipment is provided.

2. Hydronics:

a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
b. Piping is complete.
c. Water treatment is complete.
d. Systems are flushed, filled, and air purged.
e. Strainers are pulled and cleaned.
f. Control valves are functioning per the sequence of operation.
g. Shutoff and balance valves have been verified to be 100 percent open.
h. Pumps are started and proper rotation is verified.
i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
j. Variable-frequency controllers' startup is complete, and safeties are verified.
k. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111 or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" or SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 15820 "Air Duct Accessories."
3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 15082 "Duct Insulation,"

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 15810 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:

a. Measure static pressure directly at the fan outlet or through the flexible connection.
b. Measure static pressure directly at the fan inlet or through the flexible connection.
c. Measure static pressure across each component that makes up the air-handling system.
d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.

1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.

1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.

1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.

6. Measure and record all operating data.
7. Record final fan-performance data.

3.6 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

A. Adjust pumps to deliver total design gpm.

1. Measure total water flow.

a. Position valves for full flow through coils.
b. Measure flow by main flow meter, if installed.
c. If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.

2. Measure pump TDH as follows:

a. Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
b. Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
c. Convert pressure to head and correct for differences in gage heights.
d. Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
e. With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.

3. Monitor motor performance during procedures and do not operate motor in an overloaded condition.

B. Adjust flow-measuring devices installed in mains and branches to design water flows.

1. Measure flow in main and branch pipes.
2. Adjust main and branch balance valves for design flow.
3. Re-measure each main and branch after all have been adjusted.

C. Adjust flow-measuring devices installed at air handlers for each space to design water flows.

1. Measure flow at air handlers.
2. Adjust each air handlers to design flow.
3. Re-measure each air handlers after it is adjusted.
4. Perform temperature tests after flows have been balanced.

D. Verify final system conditions as follows:

1. Re-measure and confirm that total water flow is within design.
2. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
3. Mark final settings.

E. Verify that memory stops have been set.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:

1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 PROCEDURES FOR GEO-THERMAL COOLING FIELDS

A. Balance total condenser-water flows to geo-thermal cooling fields. Measure and record the following data:

1. Condenser-water flow to each branch of the cooling field.
2. Entering- and leaving-water temperatures.
3. Condenser-water flow rate recirculating through the cooling field.
4. Condenser-water flow through bypass.

3.9 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.

3.10 SOUND TESTS

A. After the systems are balanced and construction is Substantially Complete, measure and record sound levels at 5 locations as designated by the Owner.

B. Instrumentation:

1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.

2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels and measuring the equivalent continuous sound pressure level (LEQ).
3. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
4. The accuracy of the sound-testing meter shall be plus or minus one decibel.

C. Test Procedures:

1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
2. Equipment should be operating at design values.
3. Calibrate the sound-testing meter prior to taking measurements.
4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.
5. Record a set of background measurements in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
6. Take sound readings in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
7. Take readings no closer than 36 inches (900 mm) from a wall or from the operating equipment and approximately 60 inches (1500 mm) from the floor, with the meter held or mounted on a tripod.
8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:

a. Location.
b. System tested.
c. dBA reading.
d. Sound pressure level in each octave band with equipment on and off.

2. Plot sound pressure levels on NC worksheet with equipment on and off.

3.11 DUCT LEAKAGE TESTS

A. Witness the duct pressure testing performed by Installer.

B. Verify that proper test methods are used and that leakage rates are within specified tolerances.

C. Report deficiencies observed.

3.12 CONTROLS VERIFICATION

A. In conjunction with system balancing, perform the following:

1. Verify temperature control system is operating within the design limitations.
2. Confirm that the sequences of operation are in compliance with Contract Documents.
3. Verify that controllers are calibrated and function as intended.
4. Verify that controller set points are as indicated.
5. Verify the operation of lockout or interlock systems.

6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.13 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 10 and minus 5 percent.
2. Air Outlets and Inlets: Plus 10 and minus 5 percent.
3. Cooling-Water Flow Rate: Plus 10 and minus 5 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.14 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.15 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Pump curves.
2. Fan curves.
3. Manufacturers' test data.
4. Field test reports prepared by system and equipment installers.

5. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.
    e. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Position of balancing devices.

E. Air-Handling-Unit Test Reports: For air-handling units with coils, include the following:

1. Unit Data:

    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches (mm), and bore.

i. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).
j. Number, make, and size of belts.
k. Number, type, and size of filters.

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).
b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Filter static-pressure differential in inches wg (Pa).
f. Cooling-coil static-pressure differential in inches wg (Pa).
g. Heating-coil static-pressure differential in inches wg (Pa).
h. Outdoor airflow in cfm (L/s).
i. Return airflow in cfm (L/s).
j. Outdoor-air damper position.
k. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch (mm) o.c.
f. Make and model number.
g. Face area in sq. ft. (sq. m).
h. Tube size in NPS (DN).
i. Tube and fin materials.
j. Circuiting arrangement.

2. Test Data (Indicated and Actual Values):

a. Airflow rate in cfm (L/s).
b. Average face velocity in fpm (m/s).
c. Air pressure drop in inches wg (Pa).
d. Outdoor-air, wet- and dry-bulb temperatures in deg F (deg C).
e. Return-air, wet- and dry-bulb temperatures in deg F (deg C).
f. Entering-air, wet- and dry-bulb temperatures in deg F (deg C).
g. Leaving-air, wet- and dry-bulb temperatures in deg F (deg C).
h. Water flow rate in gpm (L/s).
i. Water pressure differential in feet of head or psig (kPa).
j. Refrigerant expansion valve and refrigerant types.
k. Refrigerant suction pressure in psig (kPa).

l. Refrigerant suction temperature in deg F (deg C).

G. Electric-Coil Test Reports: For electric furnaces, duct coils, and electric coils installed in central-station air-handling units, include the following:

1. Unit Data:

a. System identification.
b. Location.
c. Coil identification.
d. Capacity in Btu/h (kW).
e. Number of stages.
f. Connected volts, phase, and hertz.
g. Rated amperage.
h. Airflow rate in cfm (L/s).
i. Face area in sq. ft. (sq. m).
j. Minimum face velocity in fpm (m/s).

2. Test Data (Indicated and Actual Values):

a. Heat output in Btu/h (kW).
b. Airflow rate in cfm (L/s).
c. Air velocity in fpm (m/s).
d. Entering-air temperature in deg F (deg C).
e. Leaving-air temperature in deg F (deg C).
f. Voltage at each connection.
g. Amperage for each phase.

H. Fan Test Reports: For supply, return, and exhaust fans, include the following:

1. Fan Data:

a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches (mm), and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches (mm).

2. Motor Data:

a. Motor make, and frame type and size.
b. Horsepower and rpm.
c. Volts, phase, and hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches (mm), and bore.
f. Center-to-center dimensions of sheave, and amount of adjustments in inches (mm).
g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):

a. Total airflow rate in cfm (L/s).

b. Total system static pressure in inches wg (Pa).
c. Fan rpm.
d. Discharge static pressure in inches wg (Pa).
e. Suction static pressure in inches wg (Pa).

I. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:

a. System and air-handling-unit number.
b. Location and zone.
c. Traverse air temperature in deg F (deg C).
d. Duct static pressure in inches wg (Pa).
e. Duct size in inches (mm).
f. Duct area in sq. ft. (sq. m).
g. Indicated airflow rate in cfm (L/s).
h. Indicated velocity in fpm (m/s).
i. Actual airflow rate in cfm (L/s).
j. Actual average velocity in fpm (m/s).
k. Barometric pressure in psig (Pa).

J. Pump Test Reports: Calculate impeller size by plotting the shutoff head on pump curves and include the following:

1. Unit Data:

a. Unit identification.
b. Location.
c. Service.
d. Make and size.
e. Model number and serial number.
f. Water flow rate in gpm (L/s).
g. Water pressure differential in feet of head or psig (kPa).
h. Required net positive suction head in feet of head or psig (kPa).
i. Pump rpm.
j. Impeller diameter in inches (mm).
k. Motor make and frame size.
l. Motor horsepower and rpm.
m. Voltage at each connection.
n. Amperage for each phase.
o. Full-load amperage and service factor.
p. Seal type.

2. Test Data (Indicated and Actual Values):

a. Static head in feet of head or psig (kPa).
b. Pump shutoff pressure in feet of head or psig (kPa).
c. Actual impeller size in inches (mm).
d. Full-open flow rate in gpm (L/s).
e. Full-open pressure in feet of head or psig (kPa).
f. Final discharge pressure in feet of head or psig (kPa).
g. Final suction pressure in feet of head or psig (kPa).
h. Final total pressure in feet of head or psig (kPa).
i. Final water flow rate in gpm (L/s).
j. Voltage at each connection.

k. Amperage for each phase.

K. Instrument Calibration Reports:

1. Report Data:

a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Engineer.

B. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

E. If TAB work fails, proceed as follows:

1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.

F. Prepare test and inspection reports.

3.17 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 15950

SECTION 16010 - SUMMARY OF ELECTRICAL WORK

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish and install a complete electrical system, as specified and shown on drawings.

B. Provide all items, articles, materials, operations or methods listed, mentioned or scheduled on the drawings and/or herein, including all labor, materials, equipment and incidentals necessary and required for their completion.

C. All work shall be installed as per drawings, specifications and electrical code. Where one contradicts the other the greater shall be used.

D. Coordination required for submittals of electrical and lighting utility incentives and rebates.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. The General Provisions of the Contract, including General and Supplementary Conditions and Division 1, apply to all sections of work specified in this Division 16.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials shall be new and bear the manufacturer's name, trade name and UL label in every case where a standard has been established for the particular material. The materials to be furnished under each section of the specifications shall be the manufacturer's latest approved design.

B. Materials shall be delivered to the site and stored in original containers and be readily accessible for inspection by the Architect/Engineer until installed.

C. Materials of the same general type shall be of the same make throughout the project to provide a uniform appearance, operation and maintenance.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All work performed under this section must be done by workmen skilled in their respective trades. All work must present an appearance typical of the best trade practices. Any work not installed in this manner shall be repaired, removed and replaced or otherwise remedied as directed by the Architect/Engineer.

B. Manufacturer's direction shall be followed completely in the delivery, storage, protection and installation of all equipment and materials. The Contractor shall promptly notify the Architect/Engineer, in writing, of any conflict between any requirement of the Contract Documents and the manufacturer's directions or such written instructions from the Architect/Engineer, before proceeding with the work.

C. All work and equipment installed under Division 16 work shall be supported, plumbed, rigid and true to line. All Architectural, Structural, Mechanical, Electrical and Fire Protection drawings, shop drawings and catalog data, shall be studied thoroughly, to determine how equipment, fixtures and conduit, etc., are to be supported, mounted or suspended, and shall provide extra steel bolts, inserts, brackets and accessories for proper support whether or not show on the drawings. When directed, drawings shall be submitted showing supports for approval.

3.02 MISCELLANEOUS STEEL

A. Provide all necessary miscellaneous steel angles, channels, rods, etc., for hanging, mounting or suspending equipment, fixtures, devices, etc., installed under Division 16 work.

B. Supports installed under Division 16 work shall be suitably fastened to building structural members in a manner approved by Architect/Engineer

3.03 SPECIAL SEALS

A. After conduits and tubing are installed, the spaces around conduits shall be sealed.

B. Sealing of all spaces created for the electrical systems shall be in accordance with the requirements of the fire inspector and governing codes.

3.04 UTILITY INCENTIVES AND REBATES

A. Coordinate materials to and through the Architect as required by utility companies for submission of incentives and rebates.

B. Provide all paperwork as requested by the Architect for this purpose on behalf of the Owner.
   1. Product submittals and cutsheets of all installed materials and items.
   2. Invoices including information such as; make/model, quantities, unit prices, total costs, etc.
   3. Contractor shall sign all required forms as necessary for completion of the submission.
   4. Submittal will be coordinated through and submitted by the Architect on behalf of the Owner.

C. Contractor may be required to coordinate timing for ordering of materials and products to correspond to time requirements by the utility granting incentive or rebate. Some products may require granting of the incentive and rebate prior to ordering of materials. This may result in ordering of materials in multiple packages and at differing times for multiple deliveries. Contractor is to coordinate these requirements as communicated by the Architect.

D. Payment of all incentives and rebates will be made to the Owner, not the Contractor.

END OF SECTION 16010

SECTION 16015 - ELECTRICAL COORDINATION

PART 1 - GENERAL

1.01 COORDINATION

A. The Contractor is responsible for the proper coordination of the work specified herein.

B. Any apparatus, appliance, material or work not shown on the drawings, but mentioned in the specifications or vice versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not particularly specified, shall be furnished, delivered and installed under Division 16 work.

C. Minor adjustments in location of conduit, boxes, and/or equipment shall be made at no additional charge if so directed prior to their installation. Where offsets in conduits, additional fittings, necessary junction boxes, pull boxes, devices, etc., are required to complete the installation, to clear obstructions or the work of other trades, or for the proper operation of the system, these shall be deemed to be included in the Contract and shall be furnished and installed complete under Division 16 work.

D. The Contractor shall exchange complete original and revised drawings, details, information, etc., such that all installations are properly coordinated and fit together into a complete and acceptable project.

E. Where Division 16 work will be installed in proximity to other work or where there is evidence that the Division 16 work will interfere with other work the contractor shall assist in working out space conditions to make a satisfactory adjustment. If so directed by Architect/Engineer, the contractor shall prepare composite working drawings and sections at a suitable scale not less than 1/4 inch - 1'-0", clearly showing how work is to be installed in relation to other work. If Division 16 work is installed before coordinating with other work, or so to cause interferences with other work, the contractor shall make necessary changes in the work to correct the condition.

F. The contractor shall arrange for all chases in walls, slots in beams, openings in floor or roof, etc., required for the installation of pipes, ducts, conduits, etc., and be held responsible for the proper location of chases required for the work. The contractor shall further be responsible for having work that is required to be built in, on hand in time for proper progress.

G. The contractor shall make all measurements in the field and shall be responsible for correct fittings. The contractor shall coordinate this work with all other divisions in such a manner as to cause a minimum of conflict or delay. Division 16 work shall be coordinated in advance with other work and report immediately any difficulty which can be anticipated before installing work in question.

H. The contractor shall coordinate with other work for proper location of roughing-in a connection to equipment.

I. Refer to Architectural, Structural, Mechanical Drawings and Specifications for construction features, floor and ceiling elevations, finishes, grade elevations, work in other divisions, size and location of pipe chases and head room for same, location of walls, partitions, beams, etc., swing of doors, switches and electrical outlets and the order and time of placement of all work. No work to proceed until all details affecting or affected by these conditions have been completely developed and properly resolved.

1.02 VISIT THE PREMISES

A. The contractor is directed to visit the premises and become thoroughly familiar with the general layout of the building site and the location of the present utility lines to which connection will be made before

submitting a proposal.

B. The contractor shall also check present grades, ditches, pavements, sewers and/or any other conditions affecting the installation of electrical ducts and utilities under the Contract.

C. Offsets which may be required to leave new work clear, etc., will be included in the proposal, and the contractor assumes full responsibility for having made a proper and thorough investigation of these requirements.

D. The Contract is based upon the assumption that the contractor has investigated, understands and accepts all existing conditions.

E. While all existing storm sewers, sanitary sewers, water mains, gas mains, power lines, telephone lines and other utility services, and/or installations, both underground and overhead, may not have been indicated on the drawings, the contractor will be held expressly responsible for determining the exact location of all such service lines and/or installations encountered in the performance of the Contract and for the provision of suitable protection, support and maintenance.

1.03 SPACE REQUIREMENT

A. It shall be the responsibility of the contractor to insure that items to be furnished fit the space available, with proper provisions for access to equipment for maintenance and replacement. The contractor shall make necessary field measurements to ascertain space requirements, including those for connections, and removal of parts, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the drawings and specifications.

B. All installations shall be made to maintain maximum headroom and clearance around equipment. When space and/or headroom appear inadequate, Contractor shall notify Architect/Engineer prior to proceeding with the installation.

C. All equipment which must be serviced, operated or maintained shall be located in fully accessible positions. Minor deviations from the contract drawings may be made to allow for better accessibility, but changes of magnitude or which involve extra cost shall not be made without prior approval.

D. The contractor is responsible to determine that the equipment and appliances which are furnished can be brought into the building. No extra compensation will be allowed for dismantling of equipment to install in the available space or to obtain entrance into the building.

E. Where equipment that has been approved requires different arrangement or connections from those shown, it shall be the responsibility of the contractor to install the equipment to operate properly and in harmony with the intent of the drawings and specifications. When directed by the Architect/Engineer, the contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the contractor shall make all incidental changes in conduits, supports, wiring, heaters, panelboards, etc.

F. The contractor shall provide any additional devices, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The contractor shall be responsible for the proper location of roughing in and connections by other trades.

1.04 MATERIAL STORAGE

A. All materials shall be stored in a manner that does not interfere with the progress of work. All items

shall be stored in dry spaces.

B. Materials stored within buildings as approved by the Architect/Engineer shall be distributed in such a manner as to avoid overloading of the structural frame, and never shall be concentrated in such a manner as to exceed the equivalent of fifty (50) pounds per square foot uniformly distributed loading.

END OF SECTION 16015

SECTION 16021 - CONCRETE WORK AND ACCESS PANELS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all access doors and panels for any and all concealed devices installed under Division 16.

B. Access doors shall be provided for, but not be limited to junction boxes, pull boxes, etc., in otherwise inaccessible locations.

C. Provide concrete equipment bases under all electrical equipment mounted on ground, installed under Division 16, unless otherwise indicated.

D. Provide a minimum of 3 inch concrete encasement for underground main service feeder conduits except where conduits are run under floor slab. Maintain minimum of 3 inches between conduits where several conduits occur in the same trench.

E. Provide concrete bases for ground-mounted area lighting units.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 03300 - Cast-In-Place Concrete
Section 08305 - Access Doors.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Access panels shall be of sufficient size for the service intended or required or as indicated on the drawings.

B. Minimum size shall be 12 inches x 12 inches.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Items installed above acoustical lay-in tile ceilings shall not require access doors.

B. Provide wood boxes or frames for access panels located in plaster or ceramic tile walls. Boxes shall have proper anchoring devices and shall be installed after tile or plaster work has been completed.

C. Housekeeping Pads:

1. Provide concrete housekeeping bases under all electrical and mechanical equipment mounted on the floor or ground, installed under Division 15 or 16.
2. Establish sizes and location of the various concrete bases required and provide all necessary anchor bolts together with templates for holding these bolts in position.
3. Each concrete base shall be no less than 4 inches high and project 3 inches on all sides beyond the equipment.

END OF SECTION 16021

SECTION 16025 - CODES, FEES AND STANDARDS

PART 1 - GENERAL

1.01 CODES AND FEES

A. Unless specifically notes to he contrary, the Contractor shall furnish all equipment materials, labor and install and test in accordance with applicable sections of latest revisions published at date of bid of the following:

1. American Concrete Institute (ACI).
2. American National Standards Institute (ANSI).
3. American Society for Testing and Materials (ASTM).
4. American Institute of Steel Construction (AISC).
5. Aluminum Association (AA).
6. National Board of Fire Underwriters (NBFU).
7. Underwriters Laboratories Inc. (UL).
8. American Iron and Steel Institutes (AISI).
9. Institute of Electrical and Electronics Engineers (IEEE).
10. National Electrical Manufacturers Association (NEMA).
11. Insulated Cable Engineers Association (ICEA).
12. National Electrical Safety Code (NESC).
13. Edison Electric Institute (EEI).
14 National Electric Code (NEC).
15. Illuminating Engineering Society (IES).
16. National Bureau of Standards (NBS).
17. American Welding Society (AWS).
18. Association of Edison Illumination Companies (AEIC).
19. Uniform Building Code (UBC).
20 American Association of State Highway and Transportation Officials (AASHTO).
21. Environmental Protection Agency (EPA).
22. Occupational Safety and Health Act (OSHA).
23 Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
24. Lighting Protection Institute (LPI) Standard of Practice.
25. Life Safety Code (LSC).
26. Local State Fire Marshall's Office (SFM).
27. National Fire Protection Association (NFPA).

B. The provisions, rules, regulations and ordinances listed above are to be considered as much a part of these specifications as if repeated herein or attached hereto. All changes or modifications required to conform to such codes, regulations or requirements must be approved by the Architect/Engineer.

C. The Contractor shall comply with applicable laws, building and construction codes and applicable regulations of governing local, County, State and other applicable codes, including the Utility company. Obtain permits and inspections from authorities having jurisdiction, and pay required charges. Deliver certificates of inspection to the Architect at time of acceptance inspection.

1.02 STANDARDS

A. All materials shall be new, free of defects and shall be U.L. listed, bear the U.L. Label or be labeled or listed with and approved, nationally recognized Electrical Testing Agency. Where no labeling or listing service is available for certain types of equipment, test data shall be submitted to prove to the Engineer that equipment meets or exceeds available standards.

1.03 UTILITY COMPANY FEES, CHARGES, COSTS

A. It is the contractor's responsibility to contact the appropriate Electric and Telephone Utility Companies to determine if any fees, charges or costs will be due to the Utility Company, as required by the Utility Company for temporary power, In/Out installations, hook-ups, surveying of easements, etc. This fee, charge or cost shall be included in the contractor's bid price.

END OF SECTION 16025

SECTION 16050 - BASIC MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

B. Section 01510 - Temporary Utilities

C. Section 01520 - Temporary Construction

D. Section 01740 - Cleaning

1.02 SCOPE

A. The work shall include the furnishings of systems as defined in Section 16010 "Work Included".

B. Drawings for the work are diagrammatic, intended to convey the Scope of the Work and to indicate the general arrangement and locations of the work. Because of the scale of the drawings, certain basic items such as conduit fittings, access panels, sleeves, pull and junction boxes may not be shown. Where such items are required by Code or by other sections, such items shall be included.

C. Equipment Specification may not deal individually with minute items such as components, parts, controls and devices which may be required to produce the equipment performance specified or as required to meet the equipment warranties. Where such items are required, they shall be included by the supplier of the equipment, whether or not specifically indicated.

D. Coordinate with all trades in submittal of shop drawings. Shop drawings shall detail space conditions to the satisfaction of all concerned trades, subject to review and final acceptance by the Architect. In the event that the Contractor installs work before coordinating with other trades or so as to cause any interference with work of other trades, the necessary changes shall be made in the work to correct the condition, at no additional cost to the Owner.

1.03 TEMPORARY POWER AND LIGHTING

A. Furnish, install and maintain temporary power with ground fault protection and lighting to be used by all trades during construction. See Section 16025 for In/Out fees. The entire system shall be grounded. Payment for monthly current consumption shall be the responsibility of the Contractor. Thermal magnetic breakers or cartridges fuses only shall be used for over current protection.

1.04 SUPERVISION OF THE WORK

A. Provide field superintendent who has had a minimum of four (4) years previous successful experience on projects of comparable sizes and complexity. Superintendent shall be present at all times that work under this Division is being installed or affected. Superintendent shall be a licensed Journeyman.

1.05 ELECTRICAL CONNECTIONS

A. All connections shall be tightened to the torque valves recommended by that device manufacturers instructions. If these values are not listed, tighten to pound-inch or pound-foot values recommended in UL Standard 486B, a summary of which may be found in the National Electric Code Handbook.

1.06 ACTIVE SERVICES

A. Existing active services; water, gas, sewer, cable, fiber electric, when encountered, shall be protected against damage. Do not prevent or disturb operation of active services which are to remain. If active services are encountered which require relocation, make request to authorities with jurisdiction or determination of procedures. Where existing services are to be abandoned, they shall be terminated in conformance with requirements of the utility or Municipality having jurisdiction.

1.07 TESTS

A. Systems shall be tested by the Contractor and placed in proper working order prior to demonstrating systems to Owner.

B. After work is completed, a load balance test shall be made for each panelboard to demonstrate that with full lighting and mechanical load, the balance between phases is within 10%. Unbalanced beyond this limit shall be corrected, maintaining proper phase relation to neutral at all times. Submit to Engineer, prior to request for final inspection, a written report of existing and final load information.

1.08 DEMONSTRATIONS

A. Prior to acceptance of the work, the Contractor shall demonstrate to the Owner, or his designated representative, all features and functions of all systems and shall instruct the Owner in the proper operation of the systems. Each system shall be demonstrated once.

B. The demonstration shall consist of not less than the following:
   1. Point out the actual location of each component of a system and demonstrate its function and its relationship to other components within the system.
   2. Demonstrate the electrical system by actual "start-stop" operation showing how to work controls, how to reset protective devices, how to replace fuses, and what to do in an emergency.
   3. Demonstrate communication, signal, alarm and detection systems by actual operation of the systems and show how to reset signal, alarm and detection devices.

C. Systems to be demonstrated shall include but not be limited to the following:
   1. Service and power distribution systems.
   2. Lighting and lighting control systems.
   3. Emergency lighting systems.
   4. Motor and equipment control.
   5. Fire alarm system.
   6. Intercom and paging system.
   7. Program bell system.
   8. Security system.
   9. HVAC time control system.

D. Contractor shall furnish the necessary trained personnel to perform the demonstrations and instructions, and if necessary shall arrange to have the manufacturer's representatives present to assist with the demonstrations. The Contractor shall allow one (1) day for performing prescribed demonstrations.

E. The Contractor shall arrange with the Owner the dates and times for performing each demonstrations.

1.09 IDENTIFICATION

A. The Contractor shall provide identification for wiring systems and equipment.

B. Lettering for identification of fire alarm, telephone, TV, security, P.A. etc., shall be of sign painters quality or stencil lettering. Paint shall be fast drying sign enamel. All major pull and junction boxes for these systems except fire alarm in service areas, tunnels, above accessible ceilings and in accessible chases shall have one-half inch high black lettering identifying the system. Fire alarm shall have red lettering. Example: Fire Alarm = FA, Security = SCTY, Telephone = TEL.

C. Power and lighting circuits shall have conductors color banded, per 16120 Wire and Cable in each junction and pull box.

D. Nameplates:
1. The following, but not limited to, items shall be equipped with nameplates: All motor starters, push-button stations, control panels, time switches, disconnect switches, panel boards, contractors or relays in separate enclosures, power receptacles where the nominal voltage between any pair or contracts is greater than 150V, all switches controlling outlets or equipment where the outlets are not located within sight of the controlling switch, high voltage boxes and cabinets. Special electrical systems shall be identified at terminal cabinets and equipment racks.
2. Power panels, motor control centers and switchgear without doors, shall have circuit breakers and switches identified by engraved plastic tags affixed to cabinet adjacent to device.
3. Nameplates shall adequately describe the function of the particular equipment involved. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown on the shop drawings submitted for approval. Nameplates for panelboards, motor control centers and switchboards shall include the panel designation, voltage and phase of the supply. For example, "Panel PA, 120/208V, 3-phase, 4-wire". The name of the machine on the nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and P.B. station nameplates for that machine.
4. Nameplates shall be laminated phenolic plastic, black front and back with white core, with lettering etched through the outer covering. Attach with plated self-tapping screws or small brass screws in un-air conditioned spaces. Namplates to identify emergency devices shall be red laminate.

E. Panelboards shall have type-written circuit directories installed inside the doors under transparent plastic covers.

1.10 SUBMITTALS

A. Method of preparing and procedure for submitting Shop Drawings and submittal data shall be in compliance with the general section of these specifications.

B. Submittal data for electrical equipment shall consist of Shop Drawings and/or catalog cuts showing technical data necessary to evaluate the material or equipment, to include dimensions, wiring diagrams, performance curves, ratings, control sequence and other descriptive date necessary to describe fully the item proposed and its operating characteristics. Any submittal data in following electrical sections, peculiar to that section, is in addition to submittal requirements of this section.

1.11 EXCAVATING, TRENCHING AND BACKFILLING

A. The contractor shall do excavating necessary for underground wiring, conduit and shall backfill trenches and excavations with sand after work has been inspected. Care shall be taken in excavating that walls and footings and adjacent load bearing soils are not disturbed in any way, except where lines must cross under a wall footing. Where a line must pass under a footing, the crossing shall be made by the smallest possible trench to accommodate the conduit. Excavation shall be kept free from water by pumping if necessary. No greater length of trench shall be left open, in advance of conduit laying, than that which is required.

B. Roots shall be removed to a minimum level of eighteen (18) inches below finish grade. No roots shall be allowed to remain under any installed electrical work.

C. Backfill about the structures shall be placed, when practical, as the work of construction progresses. Backfilling on or against concrete work shall be done only when directed. Backfilling of duct lines shall progress as rapidly as the testing and acceptance of the finished sections of the work will permit and shall be carried to a crown approximately six (6) inches above the existing grades. In backfilling around duct lines, selected material shall be compacted firmly around and to a depth of not less than six (6) inches over the top of the duct. Fill and backfill and rough gradings shall be compacted thoroughly in layers and shall be brought up to within six (6) inches of finished grades. Fill and backfill shall be clean and free from vegetable matter and refuse.

1.12 CUTTING AND PATCHING

A. Cut existing walls, floors, ceilings, roofs, etc. necessary for the proper installation of new materials, equipment and related electrical items. Provide all necessary framing, lintels, hangers, etc. to maintain the structural integrity of the building system after cutting.

B. Contractor is responsible for cost to restore or patch adjacent surfaces to original condition. Employ proper professional trade for patching and finishing exposed surfaces.

END OF SECTION 16050

SECTION 16071 - SEISMIC CONTROLS FOR ELECTRICAL WORK

PART 1: GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. International Building Code Section 1621.

C. Refer to mechanical drawings for examples of seismic isolation details.

1.2 SUMMARY

A. This Section includes seismic restraints and other earthquake-damage-reduction measures for electrical components. It complements optional seismic construction requirements in the various electrical component Sections.

B. All equipment and associated systems are subject to the requirements of this section of the code except the following:

1. All electrical systems in Seismic Design Categories A and B.

2. All electrical systems in Seismic Design Category C within an occupancy with a component importance factor of 1.0.

3. Electrical systems in all seismic design categories, where the component importance factor is 1.0 and flexible connections between the components and conduit are provided, are mounted 4ft or less, and are not critical to the continued operation of the structure.

4. Electrical systems in all seismic design categories, where the component importance factor is 1.0 and flexible connections between the components and conduit are provided that weigh 20 lb or less.

5. Components supported by chains or similarly suspended from above provided that they cannot be damaged or damage any other component when subject to seismic motion and they have ductile or articulating connections to the structure at the point of attachment. The gravity design load for these items shall be three times their operating load.

6. Conduit supported by rod hangers provided that all hangers in the pipe run are 12 in. or less in the length from the tope of the pipe to the supporting structure and the pipe can accommodate the expected deflections. Rod hangers shall not be constructed in a manner that would subject the rod to bending moments.

7. High deformability conduit in Seismic Deisgn Category D, E, or F with a component importance factor greater than 1.0 and a nominal pipe size of 1 in or less where provisions are made to protect the piping from the impact of larger piping or other equipment.

8. High deformability conduit in Seismic Design Category C with a component importance factor greater than 1.0 and a nominal pipe size of 2 in. Or less where provisions are made to protect the piping from the impact of larger piping or other equipment.

9. High deformability conduit in Seismic Design Category D, E, or F, with a component importance factor equal to 1.0 and a nominal pipe size of 3 in or less.

10. High deformability piping is characterized as being constructed of ductile materials with ductile connections such as welded steel pipe or brazed copper pipe. Cast iron pipe with no-hub connections, for example, would not be characterized as high deformability piping.

11. Unbraced piping attached to in-line equipment shall be provided with adequate flexibility to accommodate differential displacements.

1.3 DEFINITIONS

A. Applicable Code: International Building Code - Structural Design chapter 16.

B. Seismic Restraint: A fixed device (a seismic brace, an anchor bolt or stud, or a fastening assembly) used to prevent vertical or horizontal movement, or both vertical and horizontal movement, of an electrical system component during an earthquake.

C. Mobile Structural Element: A part of the building structure such as a slab, floor structure, roof structure, or wall that may move independent of other mobile structural elements during an earthquake.

1.4 SUBMITTALS

A. Product Data: Illustrate and indicate types, styles, materials, strength, fastening provisions, and finish for each type and size of seismic restraint component used.
   1. Anchor Bolts: Seismic-rated, drill-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E488/E 488M.

B. Shop Drawings: For anchorage and bracing not defined by details and charts on Drawings. Indicate materials, and show designs and calculations signed and sealed by a professional engineer.

   1. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.

   2. Details: Detail fabrication and arrangement. Detail attachment of restraints to both structural and restrained items. Show attachment locations, methods, and spacings, identifying components and listing their strengths. Indicate direction and value of forces transmitted to the structure during seismic events.

C. Coordination Drawings: Plans and sections drawn to scale and coordinating seismic bracing for

electrical components with other systems and equipment, including other seismic restraints, in the vicinity.

D. Product Certificates: Signed by manufacturers of seismic restraints certifying that products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of seismic control devices for compliance with requirements indicated.

1.5 QUALITY ASSURANCE

A. Comply with seismic restraint requirements in IBC, Indiana Building Code, Code Section 1621 unless requirements in this Section are more stringent.

B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing seismic engineering services, including the design of seismic restraints, that are similar to those indicated for this Project.

C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated.

1.6 Design Requirements

A. The design requirements for this project will be listed on the drawings regarding the building category, site class, seismic design category, etc for the use in calculating the seismic forces for this project.

1.7 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural system and architectural features, and with mechanical, fire-protection, electrical, and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

PART 2: PRODUCTS

2.1 MANUFACTURERS

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:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. Erico, Inc.
4. GS Metals Corp.
5. Loos & Company, Inc.
6. Mason Industries, Inc,
7. Powerstrut.
8. Thomas & Betts Corp.
9. Unistrut Corporation.

2.2 MATERIALS

A. Use the following materials for restraints:

Indoor Dry Locations: Steel, zinc plated.

2. Outdoors and Damp Locations: Galvanized steel.

3. Corrosive Locations: Stainless steel.

2.3 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete and Masonry Anchor Bolts and Studs: Steel-expansion wedge type.

C. Concrete Inserts: Steel-channel type.

D. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A 325.

E. Welding Lugs: Comply with MSS SP-69, Type 57.

F. Beam Clamps for Steel Beams and Joists: Double sided. Single-sided type is not acceptable.

G. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

H. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.4 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8" x 1-5/8" cross section, formed from 0.1046" thick steel, with 9/16" x 7/8" slots at a maximum of 2" o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 570, GR 33.

2. Materials for Fittings and Accessories: ASTM A 575, ASTM A 576, or ASTM A 36.

3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.

4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.

1. Arrange units for attachment to the braced component at one end and to the structure at the other end.

2. Wire Rope Cable: Comply with ASTM 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3: EXECUTION

3.1 APPLICATION

A. Seismic Restraint of Electrical Services

1. Electrical conduit shall be restrained with seismic cable restraints or seismic solid brace restraints.

2. All electrical bus ducts, cable trays and ladder trays shall be restrained with seismic cable restraints or seismic solid brace restraints.

3. Transverse restraints shall occur at 30' intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.

4. Longitudinal restraints shall occur at 60' intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a duct for an electric section connected perpendicular to it if the restraints are installed within 4' of the intersection of the electric run and if the restraints are sized for the larger electric run.

5. All rigid floor mounted equipment must have a resilient media between the equipment mounting hole and the anchor bolt. Anchor bolts shall be designed in accordance with design seismic forces. Neoprene bushings shall be like Mason HG and anchor bolts shall be equal to Mason SAS or SAB.

6. Wall mounted panels shall be mounted with bushings like Mason PB. Floor mounted panels shall be mounted with bushings like Mason HG. Anchor bolts shall be equal to Mason SAS or SAB.

3.2 INSTALLATION

A. Install seismic restraints according to applicable codes and regulations and as approved by authorities having jurisdiction, unless more stringent requirements are indicated.

3.3 STRUCTURAL ATTACHMENTS

A. Use bolted connections with steel brackets, slotted channel, and slotted-channel fittings to spread structural loads and reduce stresses.

B. Attachments to New Concrete: Bolt to channel-type concrete inserts or use expansion anchors.

C. Attachments to Existing Concrete: Use expansion anchors.

D. Holes for Expansion Anchors in Concrete: Drill at locations and to depths that avoid reinforcing bars.

E. Attachments to Solid Concrete Masonry Unit Walls: Use expansion anchors.

F. Attachments to Hollow Walls: Bolt to slotted steel channels fastened to wall with expansion anchors.

G. Attachments to Wood Structural Members: Install bolts through members.

H. Attachments to Steel: Bolt to clamps on flanges of beams or on upper truss chords of bar joists.

3.4 ELECTRICAL EQUIPMENT ANCHORAGE

A. Anchor rigidly to a single mobile structural element or to a concrete base that is structurally tied to a single mobile structural element.

B. Anchor panelboards, motor-control centers, motor controls, switchboards, switchgear, transformers, unit substations, fused power-circuit devices, transfer switches, busways, battery racks, static uninterruptible power units, power conditioners, capacitor units, communication system components, and electronic signal processing, control, and distribution units as follows:

1. Housekeeping pad anchor with reinforcing rods and wedge anchor like Mason Type HPA.

2. Size concrete bases so expansion anchors will be a minimum of 10 bolt diameters from the

edge of the concrete base.

3. Concrete Bases for Floor-Mounted Equipment: Use female expansion anchors and install studs and nuts after equipment is positioned.

4. Bushings for Floor-Mounted Equipment Anchors: Install to allow for resilient media between anchor bolt or stud and mounting hole in concrete.

5. Anchor Bolt Bushing Assemblies for Wall-Mounted Equipment: Install to allow for resilient media where equipment or equipment-mounting channels are attached to wall.

6. Torque bolts and nuts on studs to values recommended by equipment manufacturer.

3.5 SEISMIC BRACING INSTALLATION

A. Install bracing according to spacings and strengths indicated by approved analysis.

B. Expansion and Contraction: Install to allow for thermal movement of braced components.

C. Cable Braces: Install with maximum cable slack recommended by manufacturer.

D. Attachment to Structure: If specific attachment is not indicated, anchor bracing to the structure at flanges of beams, upper truss chords of bar joists, or at concrete members.

3.6 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Make flexible connections in raceways, cables, wireways, cable trays, and busways where they cross expansion and seismic control joints, where adjacent sections or branches are supported by different structural elements, and where they terminate at electrical equipment anchored to a different mobile structural element from the one supporting them.

3.7 FIELD QUALITY CONTROL

A. Testing Agency:

1. Contractor will engage a qualified testing agency to perform the following field quality-control testing.

2. Engage a qualified testing agency to perform the following field quality-control testing:

3. Testing: Test pull-out resistance of seismic anchorage devices.

a. Provide necessary test equipment required for reliable testing.

b. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

c. chedule test with Owner, through Architect, before connecting anchorage device to

restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.

d. Obtain Architect's approval before transmitting test loads to the structure. Provide temporary load-spreading members.

e. Test at least four of each type and size of installed anchors and fasteners selected by Architect/Engineer.

f. Test to 90 percent of rated proof load of device.

g. If a device fails the test, modify all installations of same type and retest until satisfactory results are achieved.

h. Record test results.

END OF SECTION

SECTION 16111 - CONDUIT SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this section. The General Requirements apply to the work of this Section.

1.02 SCOPE

A. Furnish materials, tools, labor and supervision necessary to fabricate and install a complete electrical conduit system.

B. Conduit systems shall be provided for all wiring systems, except where the Drawings or other Sections of the Specifications indicate that certain wiring may be installed without conduit.

1.03 STANDARDS AND CODES

A. Methods of fabrication and installation shall copy with the provisions of all applicable Sections of the NEC.

B. Materials shall be UL and NEC approved for the application intended.

1.04 DESCRIPTION

A. This section describes the basic materials and methods of installation for conduit systems.

1.05 QUALIFICATIONS

A. The materials used in the fabrication of the conduit system shall be products of a manufacturer regularly engaged in the manufacturing of the specified material. Where a manufacturer is named for a particular material, the material of other manufacturers shall be acceptable provided the materials meets requirements of the Specification.

PART 2 - PRODUCTS

2.01 CONDUIT

A. Rigid Conduit: Full weight, threaded, rigid steel conduit, galvanized inside and out by hot dip or electrogalvanizing process. Additional protection by electrostatically applied baked coating. Thread protective caps and couplings shall remain in place prior to use. Rigid conduit to be used for exposed exterior installations, where subject to physical abuse and required by Code.

B. Electrical Metallic Tubing (EMT):
Thinwall, electrically welded cold rolled steel conduit, galvanized inside and out by electrogalvanized process. Use for conduit installed in stud walls, masonry walls, above suspended ceilings and were exposed in interior spaces not subject to physical abuse.

C. Flexible Metal Conduit:
Formed at one continuous length of spirally wound electrogalvanized steel strip. Use for final connections to any equipment subject to movement or vibration. Connections to fixtures shall be limited to 6 feet in length. All other connections shall be a maximum of 1'-6" in length.

D. Liquidtight Flexible Metal Conduit:
Formed of one continuous length of spirally wound steel strip, with water and oil tight neoprene jacket. Use for final connections to equipment listed in paragraph C above when located in wet or damp areas.

E. PVC Conduit:
Conduit shall be sunlight resistant, schedule 40, 90°C. Conduit shall be composed of polyvinyl chloride and shall conform to NEMA Standards. Conduit, fittings and cement shall be produced by the same manufacturer. May be used where buried outside building, encased in concrete, or below slabs on grade. Electrical non-metallic tubing and rigid non-metallic conduit shall not be used below grade within the building. PVC conduit shall be installed in concealed location only.

F. Type MC cable:
1. May be used as approved by Code.
2. Factory assembly of one or more insulated conductors enclosed in a metallic of interlocking tape.
3. Install all MC cable in a neat fashion. All unacceptable MC cable installation shall be removed and replaced at the Architect's discretion. MC cable shall run with buildings member and strapped as per NEC330.
4. Do not install MC cable in or on masonry walls.
5. All MC cable shall be concealed.

G. Electrical non-metallic tubing and rigid non-metallic conduit shall not be used within the building.

2.02 CONDUIT FITTINGS

A. Rigid Conduit Fittings:
Threaded, galvanized malleable iron or heavy steel, water and concrete tight.
Grounding type nylon insulated bushings for connectors at cabinets, boxes and gutters.

B. Metallic Tubing Fittings:
Set screw type steel, except in wet or concrete tight applications. For wet or concrete tight applications, use compression type galvanized steel. Use connectors with nylon insulated throats at cabinets, boxes and gutters. Indenter type and malleable iron fittings will not be allowed.

C. Flexible Metal Conduit Fittings:
Squeeze or screw type galvanized steel with nylon insulated throats.

D. Liquidtight Flexible Conduit Fittings:
Galvanized steel, with watertight gaskets, O-ring and retainer, and nylon insulated throats.

E. Conduit Fittings:
Exposed conduit fittings shall be Condulet type for sharp turns, tees, etc.

2.03 OUTLET BOXES

A. Material, size and installation for outlet boxes shall comply with NEC. Article 370.

B. Boxes shall be Raco, Steel City, Appleton or equivalent.
In general, the type of boxes shall be as follows:
1. In stud walls; For single outlet use 4 inches square by 2-1/8 inches deep box. For ganged outlets use 4-1/2 inches high by 1-5/8 inches deep multiple gang boxes. Boxes to be provide with raised covers of depth as required for thickness of wall materials.
2. In masonry and poured concrete walls; For single outlets requiring two conduit connections in top and/or bottom of box use 4 inches square by 2-1/8 inches deep box with raised square cut cover. For ganged outlets use 3-3/4 inches high by 2-1/2 inches deep multiple gang masonry box.

3. Surface-mounted wall outlets; For single outlet use 2-1/8 inches deep handy box, for double outlets use 4 inches square by 2-1/8 inches deep box. For more than two ganged outlets use 3-3/4 inches x 2-1/2 inches deep multiple gang masonry boxes. Boxes to be provided with 1/2 inch raised cover as required for device.
4. In suspended ceilings; Use 3-1/2 inches deep octagon box with fixture studs and steel mounting bars.
5. Surface outlets installed outdoors or in wet locations; Use Type FS or FD box with weatherproof cover plates for receptacles and switches.

2.04 PULL AND JUNCTION BOXES

A. Construction, sizes and installation of pull and junction boxes shall comply with NEC, Article 370 and tables 270-6 (a) and (b).

B. Pull and junction boxes not specifically described in NEC, Article 370, shall be fabricated of heavy gauge galvanized steel with screw covers and enamel finish.

C. Pull and junction boxes for installation in poured concrete floors shall be flush type, cast iron, with watertight gasketed covers. Boxes for installation in floors with tile or carpet floor covering shall have recessed brass covers and brass carpet flanges to accommodate the floor covering.

D. Pull and junction boxes for outdoor installations shall be raintight.

2.05 AUXILIARY GUTTERS

A. Construction, sizes and installation of auxiliary gutters shall comply with NEC, Article 374.

2.06 HANGERS AND SUPPORTS

A. Provide conduit hanger and support devices of approved type for method of supporting required, to include: structural steel members, suspension rods, conduit clamps, concrete inserts, expansion shields, beam clamps and welding pins. All devices shall have galvanized finish or other approved corrosion resistance finish. All supporting devices shall be manufactured for the purpose. Hangar wire and similar supports shall not be used. In general, hangers and supports shall be as follows:
   1. Where single or multiple run of conduit is routed on surface of structure; use conduit clamps mounted on Unistrut channel so as to maintain not less than 1 inch clearance between conduit and structure.
   2. Where single run of conduit is suspended from overhead; use split ring conduit clamp suspended by steel drop rod not less than 3/8 inch diameter.
   3. Where multiple parallel runs of conduit are suspended from overhead; use split ring conduit clamps uniformly spaced and supported on trapeze hangers fabricated of Unistrut channels, suspended by not less than 1/2 inch steel drop rod.
   4. Where conduit is routed in steel stud partitions, use metal stud clips, style as appropriate for application, equivalent to "Caddy" brand.
   5. Maximum hanger and support spacing shall be in accordance with NEC. Regardless of listed spacing, provide additional hangers or supports at not more than 2'-0" from each change of direction and at each side of any box or fitting.

B. Hangers and supports shall be anchored to structure as follows:
   1. Hangers and supports anchored to poured concrete; use malleable iron or steel concrete inserts attached to concrete forms.
   2. Hangers or supports anchored to structural steel; use beam clamps and/or steel channels as required by structural system.
   3. Hangers or supports anchored to metal deck; use spring clips or approved welding pins. Maximum permissible load on each hanger shall not exceed 50 pound.

4. The use of explosive force hammer actuated, booster assist or similar anchoring device will not be permitted.

PART 3 - EXECUTION

3.01 CONDUIT INSTALLATION

A. In general, horizontal runs of conduit shall be installed in ceiling spaces. Conduit for convenience outlets, wall-mounted fixtures and other wall outlets shall be routed overhead and dropped through block cells or stud walls to the outlet. Conduit shall not be installed in or below concrete floor slabs except where noted on drawings or required to serve open floor area outlets or equipment.

B. Generally, conduit shall be concealed, except in shafts, mechanical equipment rooms, and at connections to surface boxes and free standing equipment, and as otherwise noted.

C. All conduit shall be routed in lines parallel to building lines.

D. No conduit shall be installed closer than 6 inches to piping installed by other trades.

E. Minimum size conduit shall be 1/2 inch trade size. Where specific size is not called for on Drawings or in specification, Contractor shall select size required from Chapter 9 of NEC. Where specific sizes required by Drawings or Specifications are larger than Code requires, the larger size shall be installed.

F. Install the conduit system mechanically and electrically, continuous from outlet and to cabinets, junction or pull boxes, Conduit shall enter and be secured to cabinets and boxes in such a manner that all parts of the system will have electrical continuity.

G. Install insulated ground wire in all raceways. Size per NEC 250.

3.02 OUTLET BOX INSTALLATION

A. Outlet boxes shall be installed for, but not limited to, fixtures, switches, receptacles and other devices.

B. Approximate location of outlets are shown on the plans, but each location as shown shall be checked by the Contractor before installing the outlet box.

C. Wall boxes installed flush in common wall shall generally not be back-to-back or through-wall types. Where it is necessary to install boxes back-to-back, install sound absorption material between boxes and plug nipple connection with duct seal.

D. Boxes located on opposite sides of a common wall that are closely connected by conduit shall have the conduit openings plugged with duct seal.

E. Outlet boxes shall be installed plumb and square with wall face and with front of box or cover located within 1/8 inch of face of finish wall. Boxes in masonry shall be set with bottom or top of box tight to the masonry unit, unless otherwise specifed.

3.03 PULL AND JUNCTION BOX AND GUTTER INSTALLATION

A. Install pull boxes, junction boxes and auxiliary wiring gutters where required by Code and where required to facilitate installation of the wiring. In longer conduit runs, install a pull box for at least each 100 feet of conduit.

B. For concealed conduit, install boxes flush with ceiling or wall, with covers accessible and easily removable. Where flush boxes are installed in finished ceilings or walls, provide cover which shall

exceed the box face dimensions by a sufficient amount to allow no gap between box and finished material.

C. Boxes shall not be located in finished, occupied rooms, without prior approval of Architect/Engineer.

3.04 HANGER SUPPORT INSTALLATION

A. Hangers and supports shall be installed for all conduit and boxes. Supports shall be manufactured for the purpose.

B. Conduit and boxes shall not be attached to or supported from mechanical pipes, plumbing pipes or sheet metal ducts.

C. Tie wire shall not be used.

D. Work includes support frames for conduit runs to equipment.

END OF SECTION 16111

SECTION 16114 - CABLE TRAY –WIRE MESH

PART 1 – GENERAL

1.01 GENERAL

A. Provide all required cable tray, splices, connectors, fittings, horizontal bends, hanger rods and clips, channels, miscellaneous supports material and general hardware as required for a complete tray system as shown on the drawings.

1.02 RELATED DOCUMENTS

Section 16111 - Conduit Systems
Section 16120 - Wire and Cable
Division 17 - Technology & Communications

1.03 SUBMITTALS

A. Submit the following:
   1. Manufacturer's Literature.
   2. Samples, 12" long section.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following acceptable manufacturers:
   1. Cablofil.
   2. Bee-line.
   3. Chalfant.
   4. PW.
   5. T.J. Cope.
   6. MP Husky.
   7. Wiremold.
   8. Cooper.

2.02 MATERIALS

A. Carbon Steel Wire, ASTM A510, Grade 1008, Wire welded, bent and surface treated after manufacturer.

B. Finish for carbon steel wire after welding and bending of mesh: Zinc plating: ASTM B633, Type III, SC-1.

C. Cable tray will consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL classified splices where tray acts as Equipment Grounding Conductor (EGC). Wire mesh cable tray will have continuous welded top side wire to protect cable insulation and installers.

D. Provide splices, supports and other fittings necessary for a complete continuously grounded system.

E. Mesh: 2 x 4 inches (50 x 100 mm).

F. Straight Section lengths: 10 feet.

G. Wire Diameter: Patented design includes varying wire sizes to meet application load requirements; to optimize tray strength and allow tray to remain lightweight.

H. Protective safety edge on side wire to protect cable insulation and installers' hands.

I. Fittings: Wire mesh cable tray fittings are field-fabricated from straights tray sections, in accordance with manufacturer's instructions and Item C.

J. Cable Tray Size:
1. Depth: Cable tray depth to be as indicated on the drawings. If not indicated, provide as 4".
2. Width: Cable tray width to be as indicated on the drawings. If not indicated, provide as 24".

K. Cable Tray Supports and Accessories.
1. Ceiling-mounted supports mount to ceiling structure directly or with 1/4", 3/8" or 1/2" threaded rod.
2. Wall-mounted supports.
3. Splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer.
4. Accessories: As required to protect, support, and install a cable tray system.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide supports at 10' on center maximum.

B. Anchor supports rods to building structural steel using appropriate beam clamps to provide secure mounting.

C. Supports are not to be more than three feet from any tray splice.

D. Brace the tray to prevent swaying.

E. Provide a #6 bare Cu ground conductor full length of tray and bonded to each section of tray. Ground conductor to bond to nearest Cu water pipe.

F. Bolt all sections together using heavy-duty splice plates at least 7" long with a minimum of 6 bolts per splice. Torque all bolts tight per manufacturer's recommendation.

G. All conduits terminating at cable tray shall be securely fastened to cable tray using factory approved clamps.

H. Erect complete system in accordance with manufacturer's instructions.

SUBMITTAL CHECK LIST
1. Product Data
2. Sample

END OF SECTION 16114

SECTION 16120 - WIRE AND CABLE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Conditions apply to the work of this Section.

1.02 SCOPE

A. Furnish materials, tools, labor and supervision necessary to install wiring systems.

1.03 STANDARDS AND CODES

A. Methods of installation shall comply with the provisions of applicable Sections of NEC, Article 300.

B. Materials shall be in accordance with NEC, Article 310 and shall be UL listed for application intended.

1.04 DESCRIPTION

A. This Section describes the basic materials and methods of installation for general wiring systems of 600 volts and less. Wiring for a higher voltage rating, if required, shall be specified in another Section or as required.

B. Minimum size conductors shall be No. 12 AWG for power circuits, No. 14 AWG for control wiring and 20 AWG shielded for communication and sensor wiring.

1.05 QUALIFICATIONS

A. The material used for the wiring systems shall be the products of a manufacturer regularly engaged in the manufacturing of the specified material. Where a manufacturer is names for a particular material, the materials of other manufacturers will be acceptable provided the material meets requirement of the specifications.

PART 2 - PRODUCTS

2.01 WIRE AND CABLE

A. Wire and cable for power, control and signal circuits shall have copper conductors of not less than 98% conductivity and shall be insulated to 600V except as noted below. Power conductor sizes No. 10 and 12 AWG shall be solid or stranded. Aluminum wire is not permitted.

B. Type of wire and cable for the various application shall be as follows:

1. Type THW, THWN or XHHW (75°C): Use for branch circuits, and equipment power feeders in wet and dry locations, No. 12 AWG minimum.
2. Type RHH, THHN or XHHW (90°C): Use for branch circuits, and equipment power feeders in dry locations only, No. 12 AWG minimum.

2.02 CONDUCTOR COLOR CODING

A. Wiring systems shall be color coded. Conductor insulation shall be colored in sizes up through No. 8 AWG, conductors No. 6 AWG and larger shall have black insulation and shall be phase color coded with one-half inch band of colored tape at all junctions and terminations. Colors shall be assigned to each conductor as described below and carried throughout all main and branch circuit distribution.

CONDUCTOR	120/208 Volt	277/480 Volt
1. Phase >A= conductor	Black	Brown
2. Phase >B= conductor	Red	Orange
3. Phase >C= conductor	Blue	Yellow
4. Neutral conductor	White	Grey
5. Grounding conductor	Green	Green

2.03 CONNECTORS - POWER WIRING

A. In-line splices and taps for conductor sizes No. 8 AWG and smaller; use 3M Co. Scotchloc vinyl insulated spring connectors, or equivalent.

B. Insulate splices and taps to thickness of conductor insulation with half-lapped of 3M Scotch brand No. 33 vinyl electrical tape. Connectors having irregular surfaces; fill voids and smooth contours with 3M Scotchfil electrical putty prior to tapping.

PART 3 - EXECUTION

3.01 PREPARATION

A. Wire shall not be installed in the conduit system until the building is enclosed and wet work completed.

B. Conduit shall be swabbed free of moisture and debris prior to pulling in wire.

3.02 INSTALLATION

A. Splices in branch circuit wires shall be made only in accessible junction boxes.

B. Power cable shall be pulled with the use of approved pulling compound for long runs.

END OF SECTION 16120

SECTION 16164 - BRANCH CIRCUIT PANELBOARDS CIRCUIT BREAKER TYPE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of the Section.

1.02 SCOPE

A. Furnish equipment, materials, tools, labor and supervision necessary to install Branch Circuit Panelboards.

1.03 STANDARDS AND CODES

A. Fabrication and installation shall comply with applicable Section of NEC, Article 384, and shall bear UL label.

1.04 DESCRIPTION

A. Panelboards described in this Section shall be deadfront, safety type furnished with thermal-magnetic molded case circuit breakers. Shall be for lighting, receptacle and appliance branch circuit application. Circuit breakers shall have frame and trip ratings as shown on the Drawings.

1.05 QUALIFICATIONS

A. Panelboards by Square D, Westinghouse, General Electric or Siemens/ITE.

1.06 SUBMITTALS

A. Shop drawings to include fabrication details, lug and bus arrangement, ampere and voltage rating, breaker frame sizes and interrupting ratings.

PART 2 - PRODUCTS

2.01 PANELBOARDS

A. Bussing Assembly and Temperature Rise:
   1. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector to bus bar not to exceed 50°C rise above ambient. Heat rise test shall be conducted in accordance with Underwriter's Laboratories Standard UL67. The use of conductor dimensions will not be accepted in lieu of actual heat tests.
   2. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.
   3. Single-phase, three-wire panelboard bussing shall be such that any two adjacent single-pole breakers can be installed in any location.
   4. Three-phase, four-wire bussing shall be such that any three adjacent single-pole breakers are individually connected to each of the three different phases in such a manner that two of the three-pole breakers can be installed at any location.
   5. Current-carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown in the panelboard scheduled on the plans.
   6. Equipment ground bus shall be provided for all panels.
   7. All bussing and Panelboards shall be copper.

B. Safety Barriers:
   1. The panelboard interior assembly shall be dead front with panelboard front removed.

C. Cabinets and Fronts:
1. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. Wiring gutters shall be in accordance with UL Standard 67 for panelboards. Minimum gutter 6 inches each side, 5 inches top and bottom.
2. Fronts shall include doors and have flush, brushed stainless steel, cylinder tumbler-type locks with catches and spring-loaded door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike.
3. Front shall have adjustable indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted by completely concealed steel hinges. Fronts shall not be removable with door in the locked position.
4. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door. The directory card shall provide a space of at least 1/4 inch high x 3 inches long or equivalent for each circuit. The directory shall be typed to identify the load fed by each circuit.
5. Fronts shall be of code gauge, full finished steel with rust-inhibiting primer and baked enamel finish.
6. Provide surface or flush fronts as needed.

D. Wiring Terminals:
1. Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified.
2. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.

E. Circuit Breakers:
1. Quick-make, quick-break, thermal- magnetic, trip indicating, and have common trip on all multiple breakers.
2. Bolt-on type equipped with individually insulated, braced and protected connectors. The front faces of circuit breakers shall be flush with each other.
3. Large permanent individual circuit numbers shall be affixed to each breaker in a uniform position (or equip each breaker with a circuit card holder and neatly printed card identifying with circuit).
4. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF.
5. Provisions for additional breakers shall be such that no additional connectors will be required to add breakers.
6. At contractors option: Provide multipole circuit breakers where neutral sharing is allowed. All ungrounded circuits sharing neutral conductor shall have multipole breakers whether shown or not.

F. Special Breakers:
1. Ground Fault Interrupting (GFI), with test button.
2. Shunt Trip, with solenoid plunger to activate the mechanical trip release when activated by low voltage control.

G. Integrated Equipment Rating:

1. Each panelboard, as complete unit, shall have a rating equal to or greater than the integrated equipment rating shown on the panelboard schedule. Such rating shall be established by test with the circuit breakers mounted on the panelboard. The short-circuit tests on the circuit breaker shall be made simultaneously by connecting the fault to each panelboard breaker with the panelboard connected to its rated voltage source. Method of testing shall be per proposed UL standards pertaining to listing of molded case circuit breakers for high-interrupting capacity ratings. The source shall be capable of supplying the specified panelboard short-circuit current or greater. Test data showing the completion of such tests upon the entire range of distribution and power panelboards to be furnished shall be submitted to the Architect, if requested, with or before the submittal of approval drawings. Testing of panelboard circuit breakers for short-circuit rating only with a breaker individually mounted is not acceptable. Also testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Secure anchor panelboards to structure and make feeder and branch circuit connections as required. Provide unistrut as required to mount panel to structure.

B. Provide GFI breakers for circuit in lieu of individual 120v outlet GFI devices

END OF SECTION 16164

SECTION 16170 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirement of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

A. In general, disconnect switches are indicated on the Drawings, and it shall be the Contractor's responsibility to furnish and install all disconnect switches, whether indicated or not, for equipment and motors furnished.

B. Disconnect switches shall be fused unless otherwise noted. Fuse per nameplate.

1.03 STANDARDS AND CODES

A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
   1. NEC Article 380
   2. UL listed
   3. NEMA KSI - 1969

1.04 QUALIFICATIONS

A. Disconnect switches by Square D, Siemens/ITE, General Electric or Cutler-Hammer.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. Disconnects for fractional horsepower motors, 1/2-horsepower and smaller, and less than 125 volts, and for equipment of similar capacity and voltage shall be supplied integral with the equipment or shall be a standard snap switch horsepower rated.

B. Disconnects for fractional horsepower motors larger than 1/2-horsepower and for integral horsepower motors, and for equipment of similar capacity shall be general duty industrial type, with solid neutrals when required.

END OF SECTION 16170

SECTION 16199 - WIRING DEVICES AND PLATES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirement of this Section. The General Requirements apply to the work of this Section.

B. See Section 16950-Occupancy Sensors for wall switch sensors.

1.02 SCOPE

A. Provide materials, equipment, labor and supervision necessary to install Wiring Devices.

1.03 STANDARDS AND CODES

A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
   1. Receptacles; NEC Article 410K
   2. Wall Switches; NEC Article 380
   3. UL listed
   4. NEMA Standards

1.04 QUALIFICATIONS

A. Provide products, as approved by the Architect, from one of the following manufacturers:
   1. “Hubbell”.
   2. “General Electric”.
   3. “Legrand/Pass & Seymour”.
   4. “Lutron”.
   5. “Leviton”.
   6. “Arrow Hart”.

PART 2 - PRODUCTS

2.01 GENERAL

A. All wiring devices shall be "Specification Grade" except where higher grade is called for.

2.02 SWITCHES

A. Switches shall be:
   1. Single Pole Toggle Light Switch - 20 amp, 120-277 volt, “Hubbell” No. 1221, “Hubbell” No. 1221-L for lock type.
   2. Double Pole Toggle Light Switch - 20 amp, 120-277 volt, “Hubbell” No. 1222, “Hubbell” No. 1222- L for lock type.
   3. Three-Way Toggle Light Switch - 20 amp, 120-277 volt, “Hubbell” No. 1223, “Hubbell” No. 1223- L for lock type.
   4. Four-Way Toggle Light Switch - 20 amp, 120-277 volt, “Hubbell” No. 1224, “Hubbell” No. 1224-L for lock type.
   5. Single pole-double-throw center off light switch - 15 amp, 120-277 volt, “Hubbell” No. 1381.
   6. Momentary Contact Switch - 15 amp, 120-277 volt, “Hubbell” No. 1556, “Hubbell” No. 1556-L for lock type.
   7. Pilot Light Press Switch - 20 amp, 120-277 volt, Single Pole “Hubbell” No. 1297-I, Double Pole “Hubbell” No. NY 1514-I,

Three-Way “Hubbell” No. 1298-I.

8. Color: White or Grey. Location as indicated on the drawings.

2.03 DIMMER SWITCHES

A. Dimmer switches shall be:

1. Dimmer switch and ballast controller appropriate for specific lamping type being controlled; fluorescent, LED, incandescent, etc.
2. Slide type dimming control. No rotary or toggle type controls permitted.
3. Separate On/Off preset push or rocker switch permits turning lights on and off without disturbing the dimming light level setting. Switch shall return light to preset dimming level.
4. Device to fit standard single gang or multi-gang switch boxes.
5. Dual rated for 120/277 volt.
6. Shall be approved by the lighting manufacturer for use in conjunction with specified lighting fixtures and dimming ballasts.
7. Color: White or Grey. Location as indicated on the drawings.

2.04 RECEPTACLES

A. Receptacles shall be:

1. Duplex Receptacle - 2 pole, 3 wire grounding type, back and side wired, 20 amp, 125 volt, “Hubbell” No. 5362.
2. Receptacles for power and special purpose outlets shall have characteristics and NEMA configurations as per Electrical Symbols list. Supply as needed.
3. Color: White or Grey. Location as indicated on the drawings.

2.05 COVER PLATES

A. High impact resistant smooth thermalplastic. Location as indicated on the drawings. Color: White OR Stainless Steel.

B. Provide plates for all switches, receptacles, and outlets throughout the entire project. Provide blank plates for all unused outlets.

C. Plates for outlets in unfinished spaces shall be of the handy box type.

2.06 EXTERIOR RECEPTACLE COVERS

A. Provide weatherproof “While-In-Use” covers for all exterior receptacles per NEC, Section 406.8(B)(1) for Outdoor Wet Location covers, equal to “Legrand/Pass&Seymour” WIU Series.

B. Color to be selected from manufacturer’s entire selection.

2.07 GROUND FAULT INTERRUPTING RECEPTACLES (GFI)

A. Ground fault interrupting receptacles shall be duplex feed through type with test and reset buttons, equal to “Legrand/Pass&Seymour” No. 1591F.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Wiring devices shall be installed and located as follows, unless noted otherwise on the Drawings:

1. Switches: 44 inches above finished floors.
2. Receptacles: 16 inches above finished floors typically; 44 inches above finished floors or 8 inches above countertops; 48 inches above finished floors in shops, mechanical rooms, utility rooms, service spaces, and similar areas where required by the NEC.
3. Dimensions are to bottom of outlet box.

B. In masonry walls, switches and receptacle heights shall be adjusted as required so outlets are at nearest mortar joint to specified height.

C. Where light switches are located adjacent to doors, they shall be installed on knob side of door, unless indicated otherwise.

D. Where walls have wainscot finish, switch height shall be adjusted as required, so switch is either all in wainscot or all in wall above wainscot.

E. Prior to roughing-in outlet boxes, Contractor shall verify from general construction drawings; door swings, type of wall finishes and locations for counters and work benches.

END OF SECTION 16199

SECTION 16216 – INTERNAL COMBUSTION GENERATORS

PART 1 – GENERAL

1.01 Provisions of Notice to Bidders, Instructions to Bidders, Proposals, General Conditions, Supplementary Conditions, Division 1, General Requirements and of Section 16060 and 16050, are included as a part of this Section as though bound herein.

1.02 Standby generator sets shall be installed by Contractor at locations shown on plans and drawings, and as specified herein; with all accessories as required.

1.03 All equipment shall be new and of current productions of national firm, who manufactures generator, control panel, transfer panel and assembles standby generator set as a match unit, having service and parts organization within a reasonable distance of this project, backed up by a national sales and service organization. Equipment shall meet all requirements of NFPA 37, 1988 and NFPA 110, 1999.

1.04 Standby generator sets shall be supplied to operate on natural gas. Engine shall be liquid cooled by means of radiator.

1.05 Standby generator sets shall be rated continuous standby (defined as continuous for duration of any power outage) as follows:

120/240V, 1 phase, 3W, 1.0 power factor, 130° F.
160kw,
Kohler Model 160RZG

1.06 Acceptable Manufacturers: Kohler, Cummins/Onan, Caterpillar, Katolight, Generac

1.07 Successful bidder shall submit genset sizing and loads profile with submittal shop drawings.

PART 2 – PRODUCTS

2.01 ENGINE

A. Engine shall be 4 cycle, utilizing a cast iron engine block and head liquid cooled. Engine speed shall be governed by gear driven isochronous governor to maintain generator frequency within 1Hz from no load to rated load. Belt driven or velocity governors will not be considered.

B. Engine shall be equipped will following 24 volt, positive engagement, solenoid shift starting motor; 65 ampere automatic battery charging alternator; lube oil filter; low oil pressure and high water temperature cutouts; radio suppression; gas-proof seamless, stainless steel, flexible exhaust connection; flexible fuel connection; oil drain extension.

C. To maintain environmental quality, engine shall equipped with precombustion chamber fuel system or have suitable emission control equipment to ensure that gaseous exhaust emissions meet or exceed current EPA Standards in effect at time of bidding.

D. These maximum levels shall be at manufacturer's rated speed and load as measured by SAE-J177 and SAE-J215 recommended practices. Verification of ability to meet these emission specifications shall be available from engine manufacturer.

2.02 GENERATOR

A. Generator shall be four pole, brushless, 10 or 12 lead reconnectable of drip-proof construction with amortisseur windings. Insulations hall be Class H with epoxy varnish. Temperature rise of windings shall be 130°C. Generator field current shall be controlled by rotating thyrister bridge module optically coupled to firing circuit type voltage regulator. Exciter shall be 24 pole permanent magnet type.

Generators controlled by wound field exciters will not be accepted unless they meet following requirements.

B. Radio interference suppression meeting commercial standards shall be supplied. Voltage regulation shall be within ± 2% of rated voltage, from no load to rated load.

C. Upon application of full rated load in one step, voltage dip, as measured by light beam recorder or oscilloscope, shall not exceed 25% and recovery to stable voltage shall occur within 1.0 second. Stable or steady state operation is defined as operation with terminal voltage remaining constant within ± 2% of rated voltage. Voltage adjustment range shall be ± 5% of rated voltage.

D. If a line to neutral short circuit occurs, generator shall support 300% rated current for 10 seconds without externally mounted devices.

E. Resettable line current sensing circuit breaker with inverse time vs. current response shall be furnished which protects generator from damage due to overload. This breaker shall not trip within the 10 seconds specified above. Generator exciter field circuit breakers are not acceptable.

F. Provide main circuit breaker on output of generator to protect service entrance conductors. See plans for size of breaker.

G. Separate visual diagnostic means shall be furnished on the generator rotor for determining the exciter voltage is being developed and excitation system is supplying current to generator field according to load requirement.

H. Generator, having single, maintenance free bearing shall be direct connected to flywheel housing with disc coupling between rotor and flywheel.

I. Electronic isochronous governor.

J. Volts/Hz type voltage regulator shall be isolated to prevent tracking due to the SCR/computer loads.

2.03 CONTROLLER

A. Set mounted controller shall be vibration isolated on the generator enclosure. It shall be solid state design. Relays will be acceptable for high current circuits. Circuitry shall be of plug-in design for quick replacement. Controller shall be equipped to accept plug-in device capable of allowing maintenance personnel to test controller performance without operating engine.

B. Controller shall include the following minimum features:
1. Fused DC Circuits
2. Complete 2 wire start/stop control which shall operate on activation of remote contact.
3. Cranking period controlled by speed sensor which disengages starting motor when engine has started. Battery charging alternator or generator voltage may not be used for this signal.
4. Starting system shall be designed for restarting in event of false engine start by permitting engine to completely stop and then re-engage starter.
5. Cranking cycler with individually adjustable (2 to 20 seconds) ON and OFF cranking periods.
6. Over-cranking protection designed to open cranking circuit after 30-90 seconds if engine fails to start.
7. Circuitry to shut down engine when signal for high coolant temperature, low oil pressure or overspeed are received, with reset button.
8. Adjustable (2 to 10 minute) factory set at 5 minute time delay to permit unloaded running of standby set after transfer of load to normal.
9. Alarm horn.

10. Three position (automatic-off-test) selector switch.
11. Emergency stop switch.
12. Indicating lights to signal.
    a. Switch “off” (flashing red)
    b. Overcrank (red)
    c. Emergency stop (red)
    d. High coolant temperature (red)
    e. Overspeed (red)
    f. Low oil pressure (red)
    g. High battery voltage (red)
    h. Low battery voltage (red)
    i. Low fuel (red)
    j. System ready (green).
13. Test button for indicating lights
14. Connections to controller shall be plug-in wiring harnesses.

2.04 INSTRUMENT PANEL

A. A set mounted instrument panel shall include:
    1. Dual range voltmeter 3-1/2” ± 2% accuracy.
    2. Dual range ammeter 3-1/2” ± 2% accuracy.
    3. Voltmeter-ammeter phase selector switch.
    4. Direct reading pointer type frequency meter 3-1/2” ± 3 Hz accuracy.
    5. Panel illuminating light.
    6. Battery charging voltmeter.
    7. Oil pressure gauge.
    8. Coolant temperature gauge.
    9. Running time meter.
    10. Plug-in voltage regulator with front panel adjusting rheostat.

2.05 MOUNTING

A. Standby generator set shall be equipped with factory installed vibration isolators mounted between set and fabricated steel base to prevent distortion of alignment between generator and engine when installed.

B Provide concrete pad approximately 12’x6’x12” thick, with reinforcing steel, anchor bolts and miscellaneous details as required by manufacturer for securely mounting generator. Build in ¾” galvanized anchor bolts to securely anchor housing to pad. Provide Schedule 40 galvanized steel pipe sleeves through pad for passage of all conduit. A 6” layer of drainage fill shall be provided under pad using crushed stone. Compact subgrade before placing drainage fill, then thoroughly compact crushed stone with mechanical tamper. Finish surface of top pad to be approximately 6” above finish grade. Use only certified dimension and detail drawings of manufacturer for installation of all built-in items.

C. Provide exterior weathertight housing on welded steel skid with dust shield, battery rack and reinforced sheet metal housing. Housing features include fixed vane air intake vents, heated air and engine exhaust outlets and lifting handles. Stationary end panel is equipped with removable endplate for mounting meters; two trunk latches that secure closed housing; and standard control panel equipped with start/stop switch. Hinged rainshield protects control panel and U bolt arrangement permits padlocking. Provide battery box heater.

D. Generator shall be completely prewired ready for external wiring connections to terminals only consisting of: output power and input starting control from ATS; 120/208V, 1 phase, 20A circuit for heaters, lights and control panel; and remote alarm annunciation. Provide numbered terminal strips and main power output bolted pressure lugs of sizes as required.

2.06 ACCESSORIES

A. Engine block heater, 208 volt, of size required to maintain water temperature @ 50° F @ - 20° F.

B. Generator strip heater, 120V, to prevent condensation during high humidity.

C. 900 CCA (min.), 12 volt battery (2 required), battery rack and battery cables.

D. Fifteen (15) ampere automatic float battery charger Model 269215 with constant voltage regulation, current limiting capability, temperature compensated for ambients from -20° F.; voltmeter and ammeter; equalizer timer (0-12 hrs.) , equipped for conduit installation.

E. Engine exhaust silencer rated for critical application mounted on top of housing with rain shield. Noise < 85 dBA at 10 feet.

F. Remote annunciator panel (16 light) to meet NFPA 99 requirements. Unit to be surface mounted over flush box.

2.07 AUTOMATIC TRANSFER SWITCHES

A. Automatic transfer switches, 3 phase, 60 Hz, 3 pole, with solid neutral for voltage specified herein shall be provided. Switch shall conform with provisions of UL 1008 and NFPA 110-4-2 Standards for Automatic Transfer Switches. Circuit breakers modified to be mechanically interlocked and controlled to act like transfer switch are not considered as equal and are unacceptable.
   1. One 600A, 3 phase switch, and One 400A single phase switch.
   2. NEMA 1 enclosure.

B. Transfer switches shall be equipped with following accessories.
   1. Four time delay relays.
   2. Generator exercising timer with load, set for 15 min. each week.
   3. One auxiliary contact.
   4. Accessory #27 (In-phase monitor)

C. Acceptable manufacturers: ASCO Series 300 or equal by Kohler, Onan.

PART 3 – EXECUTION

3.01 TESTING

A. Generator set shall be completely tested in accordance with NFPA 110-5-13 AND as follows:

B. Before shipment, generator set shall be completely tested as follows:
   1. 100% load tested for 1 hour (min.) at rated KW continuous.
   2. Four repetitive 5 minute cycles of single step application and removal of 100% load.

C. Certified test log of generator set test shall be submitted. Voltage and frequency readings shall be taken and permanently recorded on chart recorder of oscillograph. Also record fuel consumption, water and exhaust gas temperatures. Indicate ambient condition and methods used.

D. After generator set has been installed, field testing shall be done in presence of the Owner and Engineers as follows:
   1. Before field start up of unit, a complete checking of the installation shall be performed by an authorized factory trained technician. Every facet of the installed unit shall be inspected in accordance with written factory instructions (check list) to guarantee the generator is safe to start,

be tested under full load, and run indefinitely according to its intended permanent usage. A copy of this complete check list shall be included in the Owner's O&M Manuals.

2. Simulate power failure by disconnecting main source of power.
3. Run 100% load test continuously for 4 hours using building load and adding load bank as required to provide adequate load.
4. Test all components and operation of automatic transfer switch.
5. Calibrate all meters.

E. Record all readings of voltage, frequency and time lag from failure to full load. Factory Engineer shall suspend no less than one eight-hour work day to supervise startup, testing and adequate instruction to operating personnel.

3.02 Engine cooling system shall be filled with 505 glycol/water to protect from freezing.

END OF SECTION 16216

SECTION 16426 - MAIN DISTRIBUTION SWITCHBOARD

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

A. Provide materials, equipment, labor and supervision as required for the complete installation of the Main Distribution Switchboard.

1.03 CODES AND STANDARDS

A. Switchboard shall be completely factory assembled, wired and tested before delivery and shall bear UL labels and be service entrance rated. Designs shall meet NEC and NEMA standards, as well as OSHA requirements.

1.04 QUALIFICATION

A. Main Distribution Switchboard shall be Square D, or equivalent by Siemens ITE, General Electric or Cutler-Hammer.

1.05 SUBMITTALS

A. Submittal data for the switchboard shall consist of shop drawings showing technical data necessary to evaluate the equipment, to include dimensions and weights of switchboard cubicles, fabrication materials, bus arrangement, ratings and other descriptive data necessary to describe fully the equipment proposed.

B. Submittal data to include detail wiring diagram of interlocking control, if any. Detail information on the performance, characteristics and ratings of the switch units shall be included.

PART 2 - PRODUCTS

2.01 GENERAL

A. These specifications and associated drawings describe the indoor Main Distribution Switchboard Assembly. The assembly shall be designed for use on a 3-phase, 4-wire with ground, 60 Hz system of voltage rating indicated on the Drawings, and shall be complete from the incoming line connections. Items not specifically mentioned but necessary for proper operation are implied in this description.

B. Provide metering compartment as per local power company requirements, unless otherwise noted.

2.02 CONSTRUCTION

A. The switchboard shall be dead front with accessibility only where required. The framework is to be of code gauge steel, rigidly welded and bolted together. Support all cover plates, bussing and component devices during shipment and installation. Formed removal closure plates shall be used on the front and rear. All closure plates are to be screw removable. Ventilating louvers shall be provided when required. The switchboard will have adequate lifting means and be capable of being rolled into its installation position. Exterior and interior metal surfaces of the switchboard shall be finished with baked enamel over an iron phosphate pre-treatment. The enamel finish shall be medium light gray ANSI #49.

B. Individual shipping sections shall be designed for bolting together at the installation site. Necessary bolting hardware, as well as main bus splices, shall be supplied between adjacent shipping sections.

C. Engraved namplates shall be furnished for main and feeder circuits. Nameplate material to be phenolic laminate. Black face with white (lettering) core.

2.03 BUSSING

A. The switchboard bussing is to be copper or aluminum and of sufficient cross-sectional area to meet UL Standard #891 for temperature rise. The through bus shall have a maximum ampacity and short circuit current ratings as shown on the Drawings. Provide full neutral bus and a ground bus. The distribution panel bussing shall be of suitable design for the installation of fusible switches or circuit breakers as scheduled on the drawings and have an Underwriter=s Laboratories short circuit current rating adequate for the application.

B. Integrated Equipment Rating: Each panelboard, as a complete unit, shall have a rating equal to or greater than the integrated equipment rating shown on the panelboard schedule. Such rating shall be established by test with the circuit breakers mounted on the panelboard. The short-circuit tests on the circuit breaker and on the panelboard structure shall be made simultaneously by connecting the fault to each panelboard breaker with the panelboard connected to its rated voltage source. Method of testing shall be per proposed UL standards pertaining to listing of molded case circuit breakers for high-interrupting capacity ratings. The source shall be capable of supplying the specified panelboard short-circuit current or greater. Test data showing the completion of such tests upon the entire range of distribution and power panelboards to be furnished shall be submitted to the Architect, if requested, with or before the submittal or approved drawings. Testing of panelboard circuit breakers for short-circuit rating only with the breaker individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to this bus structure is not acceptable.

2.04 MAIN DISCONNECT DEVICES

A. Main disconnect device and fusible switch units rated above 800 amperes shall be bolted pressure contact fusible switches. Fusible switch units rated 800 amperes and below shall be quick-make, quick-break type. Fuses for the switches shall be of the type and rating shown on the drawings or full size of the switch unit.

2.05 BRANCH CIRCUIT PROTECTION DEVICES

A. The branch fusible switch(es) shall be quick-make, quick-break and group mounted in panel construction. Provisions for current limiting fuses shall be provided by the manufacturer.

B. Circuit Breakers:

1. Equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other.
2. Large, permanent, individual circuit number shall be affixed to each breaker in a uniform position (or equip each breaker with a circuit card holder and neatly printed card identifying the circuit).
3. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF.
4. Provisions for additional breakers shall be such that not additional connectors or hardware will be required to add breakers.

2.06 SPARE FUSE CABINET

A. Provide and install in a convenient location, in the same room containing this specified switch gear, a metal wall hung cabinet containing three (3) fuses of each type and rating used in electrical equipment in that room.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide and install main distribution switchboard as indicated on the Drawings.

B. Provide busway openings and termination as indicated on the Drawings.

C. Provide 4” high concrete housekeeping pad for switchboard and distribution sections including space for future distribution sections if shown on Drawings.

END OF SECTION 16426

SECTION 16450 - GROUNDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Document complement the requirements of this Section. The General Conditions apply to the work of this Section.

1.02 SCOPE

A. This section deals with the grounding of service equipment, transformers, non-current carrying conductive surfaces of equipment, metal buildings, structures and other equipment.

1.03 STANDARDS AND CODES

A. All grounding connections shall be installed in accordance with the National Electrical Code and applicable local code requirements. Such codes shall be considered minimum requirements and the installation of the grounding system shall insure freedom from dangerous shock exposure and shall provide a low impedance ground fault path to permit operation of overcurrent and ground fault protective devices.
   1. NEC Article 250
   2. National Electrical Safety Code.

1.04 QUALIFICATIONS

A. Use Thomas and Betts compression ground system, exothermic welds or an approved listed compression type system.

PART 2 - PRODUCTS

2.01 CONDUCTORS

A. All grounding conductors whether insulated or not shall be copper.

2.02 GROUND RODS

A. All ground rods shall be copper clad steel, 3/4 inch by 10 feet solid type.

2.03 GROUND CONNECTIONS

A. The connection of a grounding conductor to ground rods or ground conductor to ground conductor shall be by means of Thomas & Betts compression ground system, or exothermic weld.

B. Ground connections to building steel or equipment shall be bolted using T & B compression type lugs.

C. Slab penetrations of ground conductors shall terminate on T & B compression type flush plate connectors installed flush in slab. Interior connections of flush plate connectors shall be made using compression lugs.

D. Grounding conductor connections at conduit terminations shall be made by approved listed grounding bushings.

PART 3 - EXECUTION

3.01 MAIN SERVICE GROUND

A. In accordance with NEC Article 250-81, each of the following shall be bonded together to form the grounding electrode system:

1. Metal underground water pipe in direct contact with the earth for 10 feet or more (provide jumpers around water meter).
2. Metal frame of the building where effectively grounded.
3. Concrete-encased electrode consisting of a minimum of 20 feet of No. 3/0 AWG bare copper in the footing.
4. Counterpoise (Ground Ring) for lightning protection system (if lighting protection is installed).

B. This grounding system shall be supplemented by three copper clad steel ground rods 3/4 inches in diameter by 10 feet long. The ground rods shall be driven a distance of 10 feet apart.

C. The grounding electrode system shall be connected to the grounded circuit conductor (neutral) on the supply side of the service disconnecting means by a grounding electrode conductor. The grounding electrode conductor will be sized as shown in Table 250-94 of the National Electrical Code.

3.02 FEEDER AND BRANCH CIRCUITS

A. All feeders and branch circuits shall have installed in the same raceway as the circuit conductors, an insulated copper grounding conductor sized in accordance with Table 250-95 of the National Electrical Code unless such a grounding conductor is shown to be larger on the plans or specified to be larger elsewhere in the specifications.

3.03 EXPOSED NON-CURRENT CARRYING CONDUCTIVE SURFACES

A. All exposed non-current carrying conductive surfaces of electrical equipment shall be grounded to the equipment conductor run with the circuit conductors or a separate ground as shown on the drawings.

END OF SECTION 16450

SECTION 16470 - DISTRIBUTION PANELBOARDS CIRCUIT BREAKER TYPE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this section.

1.02 SCOPE

A. Provide equipment, materials, tools, labor and supervision necessary to install Distribution Panelboards.

1.03 STANDARDS AND CODES

A. Fabrication and installation shall comply with applicable Sections of NEC, Article 284, and shall bear UL label.

1.04 DESCRIPTION

A. Panelboards described in this Section shall be deadfront, safety type furnished with thermal magnetic, molded case circuit breakers. Shall be for power distribution application and when required shall be suitable for service equipment. Circuit breakers shall have frame and trip ratings as scheduled on Drawings.

1.05 QUALIFICATIONS

A. Panelboards by Square D, Westinghouse, General Electric or Siemens/ITE.

1.06 SUBMITTALS

A. Shop drawings to include fabrication details, lug and bus arrangement, ampere and voltage rating, breaker frame sizes and interrupting ratings.

PART 2 - PRODUCTS

2.01 PANELBOARDS

A. Bussing Assembly and Temperature Rise:
   1. Panelboard bus structure and main lugs or main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise test with maximum hot spot temperature on any connector or bus bar not to exceed 50°C rise above ambient. Heat rise tests shall be conducted in accordance with Underwriters= Laboratories Standard UL67. The use of conductor dimensions will not be accepted in lieu of actual heat tests.
   2. Equipment ground bus shall be provided for all panels.

B. Safety Barriers:
   1. The panelboards interior assembly shall be deadfront with panelboard front removed.

C. Cabinet:
   1. Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 50 for cabinets. The size of wiring gutters shall be in accordance with UL Standard 67.
   2. Cabinets to be equipped with spring latch and tumbler-lock on door of trim. Doors over 48 inches long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. Endwalls shall be removable.
   3. Fronts shall be of code gauge, full-finished steel with rust-inhibiting primer and baked enamel

finish.

D. Circuit Breakers:
1. Equipped with individually insulated, braced and protected connectors. The front faces of all circuit breakers shall be flush with each other.
2. Large, permanent, individual circuit numbers shall be affixed to each breaker in a uniform position (or equip each breaker with a circuit card holder and neatly printed card identifying the circuit).
3. Tripped indication shall be clearly shown by the breaker handle taking a position between ON and OFF.
4. Provisions for additional breakers shall be such that no additional connectors or hardware will be required to add breakers.

E. Integrated Equipment Rating:
1. Each panelboard, as a complete unit, shall have a rating equal to or greater than the integrated equipment rating shown on the panelboard schedule. Such rating shall be established by test with the circuit breakers mounted on the panelboard. The short-circuit tests on the circuit breaker and on the panelboard structure shall be made simultaneously by connecting the fault to each panelboard breaker with the panelboard connected to its rated voltage source. Method of testing shall be per proposed UL standards pertaining to listing of molded case circuit breakers for high-interrupting capacity ratings. The source shall be capable of supplying the specified panelboard short-circuit current or greater. Test data showing the completion of such tests upon the entire range of distribution and power panelboards to be furnished shall be submitted to the Architect, if requested, with or before the submittal or approved drawings. Testing of panelboard circuit breakers for short-circuit rating only with the breaker individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure is not acceptable.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Securely anchor panelboards to structure to make feeder connection as indicated and as required.

END OF SECTION 16470

SECTION 16471 - FEEDER AND BRANCH CIRCUITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Conditions apply to the work of this Section.

1.02 SCOPE

A. Provide materials, equipment, labor and supervision necessary to install feeder and branch circuits to include, but not limited to:
   1. Conductors
   2. Conduit fittings and boxes
   3. Overcurrent protection
   4. Panelboards
   5. Conduit hangers and supports
   6. Wiring devices
   7. Motor and equipment connections

1.03 STANDARDS AND CODES

A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
   1. Branch circuits: NEC Articles 210 and 220
   2. Feeders; NEC Articles 215 and 220
   3. Motor circuits; NEC Article 430
   4. Grounding; NEC Article 250

PART 2 - PRODUCTS

2.01 FEEDER CIRCUITS

A. A riser diagram and general layout of feeder circuits are indicated on the drawings. The Contractor shall lay out the feeders generally as indicated, but shall determine the exact layout and routing of feeders so as to best fit the layout of the work.

B. Conductor sizes for feeder circuits are noted on the drawings or panel schedules.

2.02 BRANCH CIRCUITS

A. A general layout of branch circuit wiring is indicated on the drawings. Receptacles and appliances shall be on separate circuit from lighting.

B. Branch panel circuits are numbered to match NEMA pole numbering system; poles 1 and 2 - Phase A, poles 3 and 4 - Phase B, poles 5 and 6 - Phase C, etc.

C. No. 14 wire will be permitted only on control circuits of relays, contractors, starters, etc. No. 12 wire will be minimum size for any lighting, motor or general branch circuits unless specifically noted otherwise.

D. Conductor sizes for major branch circuits, such as large motor and equipment branch circuits, are noted on the drawings.

E. Conductor sizes for lighting, receptacles and small motor branch circuits, with less than 20 ampere connected load, are not shown on drawings. Conductors for such circuits shall be sized as follows:

1. Conductor size for branch circuits 100 feet in length from branch circuit panel to center of load shall not be smaller than No. 12; over 100 feet not smaller than No. 10.
2. Conductor size for exit light circuits shall not be smaller than No. 10.

F. Where specific conductor sizes required by the drawings are larger than Code required, the larger sizes shall be installed.

G. Circuits may be arranged in 4-wire feed, 3 circuits and common neutral, in color code previously described, more than 3 circuits in conduit is not permitted.

END OF SECTION 16471

SECTION 16485 - MOTOR STARTER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

A. Provide materials, equipment, labor and supervision as required for the complete installation of Motor Starters as required for any motor connections.

1.03 CODES AND STANDARDS

A. Motor Starter shall be completely factory assembled, wired and tested before delivery and shall bear UL labels. Designs shall meet NEC and NEMA standards, as well as OSHA requirements.

1.04 QUALIFICATION

A. Motor Starter by Square D, Siemens ITE, General Electric or Cutler-Hammer.

1.05 SUBMITTALS

A. Submittal data for the Motor Starter shall consist of shop drawings showing technical data necessary to evaluate the equipment, to include dimensions and weights, fabrication materials, bus arrangement, ratings and other descriptive data necessary to describe fully the equipment proposed.

B. Submittal data to include detail wiring diagram of interlocking control, if any. Detail information on the performance, characteristics and ratings of the circuit breakers shall be included.

PART 2 - PRODUCTS

2.01 GENERAL

A. These specifications and associated drawings describe the Motor Starters. Items not specifically mentioned but necessary for proper operation are included in this description.

B. Except as otherwise indicated, provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics as needed, which comply with manufacturer=s standard materials, design and construction in accordance with published product information, and as required for complete installations. Provide phase loss and low voltage protection relay in the control circuits of all motors 7-1/2 HP and larger. Starters shall be a minimum of size 1.

2.02 CONSTRUCTION

A. AC Fractional HP Manual Starters: Provide manual single-phase fractional HP motor starters, of types, ratings and electrical characteristics indicated; equip with thermal overload relay for protection of 120V AC motors of 1/2 HP and less. Provide starters with quick-make, quick-break trip free toggle mechanisms; mount starter in NEMA Type I general purpose enclosure.

B. AC Full Voltages: Provide full voltage alternating current magnetic starters, consisting of contactors and overload relays mounted in common enclosures; of type, size, ratings and NEMA sizes indicated. Overload relays to be block type with manual reset. Control voltage to be 120V with minimum for two sets of auxiliary contacts, (one - NO and one - NC) or as required for controls specified. Provide other control components as needed (H-0-A) switches, push buttons, pilot lights, etc.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide and install Motor Starters as indicated on the Drawings, and as necessary for proper operation of all equipment.

B. Install fuses in fusible disconnects, if any.

C. Install heaters, sized to provide protection in accordance with the manufacturer′s recommendations and the NEC in overload relays.

D. Locate starters and VFD's adjacent o the panels that they are served from unless otherwise shown on drawings.

END OF SECTION 16485

SECTION 16500 - LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section.
The General Requirements apply to the work of this Section.

1.02 SCOPE

A. Provide lighting fixtures, accessories, labor, and supervision necessary to install a complete Lighting System.

1.03 STANDARDS AND CODES

A. Except where otherwise required by this Section, the following Standards and Codes shall govern:
1. NEC Article 410.
2. UL listed.

1.04 SUBMITTALS

A. Submit catalog cuts giving complete description of fixtures to include photometric curves and method of installation.

1.05 QUALIFICATION

A. The lighting fixtures listed in the fixture schedule are the basis for design.
Includes both aesthetic and performance requirements.

B. Requests for approval for substitutions must be submitted per Section 01630, complete with all supporting data and product information.

C. Final review for fixtures will be when shop drawings are submitted.
The Architect reserves the right to reject and fixtures which, in his opinion, do not meet the overall lighting system design. Upon request, the fixture supplier shall submit sample fixtures.

PART 2 - PRODUCTS

2.01 FIXTURES

A. Provide fixtures as indicated on drawings.

B. Recessed fixtures in soffits and solid surface ceilings shall be furnished with trim kits and supports compatible with construction.

C. See Electrical Drawings and Lighting Fixture Schedule for additional requirements of all fixtures.

2.02 LED FIXTURES

A. LED Lamps shall have system life rated to retain a minimum of 70% light output at 50,000 hours of use (L70 at 50,000 hours).

B. LED lamp color temperatures shall be rated at CRI > 80.

C. If lumens are indicated on fixture schedule, it is the minimum delivered lumens of output required.

D. If fixture watts are indicated on fixture schedule, it is the maximum nominal input wattage permitted.

E. Provide adapters as required for depths of construction at each location and condition. Provide correct trim and mounting as required for each location and condition.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install fixtures; coordinate exact location with Architect's Drawings.

B. Fixtures shall be grounded.
Lamp sockets shall be wired so that the outer shell is connected to the neutral grounded conductor.

C. Recessed fixtures in removable ceilings shall be connected to the branch circuit with flexible conduit and branch circuit wire from an accessible junction box. Fluorescent fixtures shall not be used for branch circuits feed-through.

D. Fixtures recessed in furred ceiling shall be installed so that they can be removed from below the ceiling.

E. Fixtures installed in plastered or solid ceilings shall not be supported directly from the ceiling. Support fixtures from metal bar hangers, stud framing, or Unistrut channels attached to the structure.

F. Fixtures installed in acoustical lay-in ceilings shall not be supported directly from ceiling or grid. Support fixtures from metal bar hangers, rods, or cables attached to the structure.
Install supports per requirements of the NEC, IBC, and local authorities, but never less than two opposing corners.

G. Provide unswitched “hot” conductor from same circuit serving lighting in that area to provide continuous power to nightlight emergency lighting and exit lighting, whether shown or not.

H. Make final connections between fixtures and wiring system.

I. Replace any lamps which do not operate properly, or which have been used for temporary lighting.

END OF SECTION 16500

SECTION 16601 – TRANSIENT VOLTAGE SURGE SUPPRESSORS

PART 1 - GENERAL

1.01 WORK INCUDED

A. This section describes the materials and installation requirements for transient voltage surge suppressors (TVSS) for the protection of all AC electrical circuits from the effects of lightning induced currents, substation switching transients and internally generated transients resulting from inductive an/or capacitive load switching.

B. Provide all required materials to effect a complete installation. Surge suppression for each building service entrance location as designated in the prints and/or schedules shall be furnished and installed by the electrical contractor.

1.02 REFERENCES

A. ANSI/IEEE C62.41-1980 (Formerly, IEEE Std 587-1980), Guide for Surge Voltage in Low Voltage AC Power Circuits. For purposes of this specification, the following shall be the requirements for voltage amplitude.
   1. For category C, 20KV, 10KA waveform exposure level and a suppressor with L-G = 120KA and N-G = 120KA surge current capacity (240KA/phase surge current capacity)

B. ANSI/IEEE C62.11-1984, Standard for Surge Arrestors for AC Power Circuits.

C. ANSI/IEEE C62.33-1982, Standard for Test Specifications for Varistor Surge Protection Devices.

D. ANSI/IEEE Standard 81-1983, Guide for Measuring Earth Resistivity, Ground Impedance and Earth Surface Potentials of a Ground System.

E. Underwriters Laboratories, UL 1449, Standard for Safety, Transient Voltage Surge Suppressors, Revised edition, effective date July 2, 1987.

F. Underwriters Laboratories UL 1283, EMI/RFI filtering Sytems

1.03 SUBMITTALS

A. Provide product data for each suppressor type.

B. The surge suppression submittal shall also include, but shall not be limited to, the following additional data:
   1. Dimensions for each suppressor type indicating mounting arrangement and required accessory hardware.
   2. Manufacturer’s certified test data derived from test results conducted on a completed unit indicating the ability of the product to meet or exceed the requirements of this specification. This data shall form a certified independent testing laboratory.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. L.E.A Dynatech

B. Current Technology

C. EFI Electronics

D. Hubbell

E. Liebert
F. GE
G. Cutler-Hammer Clipper
H. Siemens
I. Square D
J. Advanced ProtectionTechnologies
K. Innovative Technologies
L. Tycor
M. United Power

2.02 MANUFACTURER QUALIFICATIONS

A. All surge suppression devices shall be manufactured by a company normally engaged in the design, development and manufacture of such devices for the protection of electrical circuits and electronic equipment.

B. The surge suppressor manufacturer shall offer factory repair service for all nonencapsulated assemblies and replacement for an encapsulated unit.

2.03 SUPPRESSOR PREFORMANCE CRITERIA

A. System shall have disconnecting means provided. Unit shall be installed in a separate cabinet as required. Unit shall not be integrated into panelboard or switchboard.

B. Suppressors shall be listed for hardwired devices in accordance with UL 1449, Standard for Safety, Transient Voltage Surge Suppressors Revised edition, effective date July 2, 1987. Maximum UL 1449 listing of 400 volt let through for 120/208V and 800 volt for 277/480V.

C. For 3 phase, 4-wire configurations, suppressors shall provide suppression elements between all phase conductors and the system neutral, all phases and system ground, and between neutral and ground, providing a total of seven (7) suppression elements.

D. Suppressor manufacturer shall provide certified test data confirming the TVSS will fail short in a safe and non-violent manner. If over current protection devices are used, the manufacturer shall certify that the device is capable of conducting the specified transient current.

E. Visible indication of proper suppressor connection and operations hall be provided for all modes of protection including N-G.

F. The mounting position of the suppressor shall permit a straight and short lead length connection between the suppressor and the point of connection to the panel board per all codes. Maximum lead length shall be 18 inches.

G. EMI/RFI filtering portion of system shall meet or exceed the following criteria.
1. Noise attenuation of a minimum of 55 db throughout a range of 10khz to 1 mhz. Minimum of 50 db throughout a range of 1 MHZ to 100 MHZ.
2. All ratings and testing results shall be based on UL 1449 and UL1283 recommendations.

H. Suppressors shall have turn-on and turn-off times of less than five nanoseconds.

I. Suppressors shall be of solid-state componentry and shall operate bi-directionally and bi-polar.

J. Suppressors shall be braced to withstand 200,000 amps sym. fault current.

K. Where suppressors are shown to be directly connected to a hot bus without panel/switchboard over-current protection, the suppressions hall have over-current fuses built into the TVSS.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide category C TVSS for service entrance locations.

3.02 WARRANTIES

A. All surge suppression devices and supporting components shall be guaranteed by the installing contractor to be free of defects in materials and workmanship for a period of one year from the date of substantial completion of the system to which the suppressor is attached. In addition, the manufacturer of the suppression devices shall give a concurrent minimum 5 year warranty on the equipment, excluding installation labor, if any.

END OF SECTION 16601

SECTION 16610 - ELECTRICAL HEATERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required for installation of electric heaters.

B. Electric heaters are as indicated or scheduled on the drawings.

1.02 SUBMITTALS

A. Product Data: Indicate unit operation, characteristics, wiring diagrams, power requirements, configuration and finish for each type of unit specified.

1.03 QUALITY ASSURANCE

A. Assembly: UL listed and labeled, with thermal box and cover and built-in controls.

1.04 DELIVERY, STORAGE AND HANDLING

A. Do not install before building is weathertight.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide products, as approved by the Architect, from one of the following acceptable manufacturers:
   1. “Dayton”
   2. "Q-Mark"
   3. "Markel"
   4. "Chromalox"
   5. "Brasch"

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's published installation instructions and as required by NEC Article 424.

END OF SECTION 16610

SECTION 16620 – LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section includes all design, engineering, labor, materials and items of service to complete a functional and unobtrusive lightning protection system approved by the Architect.

B. All work of this section included in Alternate No. 3.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Section 01230 – Alternates
Section 16010 – Summary of Electrical Work.
Section 16450 - Grounding

1.03 QUALITY ASSURANCE

A. Meet the following standards and guidelines:
1. Lightning Protection Institute Installation Standard LPI-175
2. National Fire Protection Association Code NFPA 780
3. Underwriters' Laboratories Standards UL96A and UL 96

B. Upon completion of the work, obtain and deliver to the Owner the “Underwriters Master Labels” for attachment to the building where directed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Acceptable Manufacturer's
1. Thompson Lightning Protection
(651) 455-7661
2. Kuefler Lightning Protection
(406) 745-3800
3. Ohio Valley Lightning Protection
(937) 987-0245

B. All materials shall be new and properly labeled with UL or LPI certifications.

2.02 CABLES

A. Downlead conductors from roof to ground:
1. Copper
2. 29 strands
3. 17 gauge

B. Main roof conductors:
1. Aluminum
2. 24 strands
3. 14 gauge

C. Fasteners: Electrolytically compatible with conductor and mounting surface

D. Approved bimetal transition fitting shall be used at the roof level to change from aluminum roof conductor to copper downlead conductor.

2.03 AIR TERMINALS

A. Bases:
1. Cast aluminum
2. Bolt pressure cable connection
3. Stainless steel mounting screws
4. Various designs form wall, parapet or metal roof mounting

A. Terminals:
1. Solid round aluminum
2. 1/2" diameter
3. Minimum 10" projection above object to be protected

2.04 GROUND RODS

A. Minimum 5/8" diameter x 10 feet long

B. Connectors to system
1. Two-bolt bronze clamp
2. Minimum length 1-1/2"
3. Stainless steel cap screws

2.05 MISCELLANEOUS

A. All miscellaneous bolts, nuts and screws to be stainless steel.

PART 3 - EXECUTION

3.01 DESIGN

A. System shall include complete design drawings illustrating locations of all air terminals, base connection details, main roof conductor routing, downlead conductor routing and ground rod locations.

B. Air terminals shall be wall mounted verses roof mounted at edges to eliminate penetrations in roofing.

C. Conductor routing shall be hidden from view.

D. Architect must approve all terminal mounting and conductor routing and no deviation from approved drawings will be permitted.

3.02 INSTALLATION

A. All work shall be accomplished by experienced installers working under the direct supervision of a Certified Master Installer of the LPI.

B. All equipment shall be installed in a neat workmanlike manner.

C. Downlead cables must NOT penetrate roofing system. Cables shall be installed in conduit in the general construction of the building.

3.03 COORDINATION

A. Work with other trades to insure a correct, neat and unobtrusive installation.

B. Conduits and other materials to be installed concealed in the general construction shall be provided

and installed in a timely manner with the overall construction progress.

C. Any penetrations of the roof system MUST be with the approval and coordination of the roofing installer and manufacturer to maintain roof system warranty.

D. Installer shall assure a sound bond to the main water service and interconnection with other building ground systems.

SUBMITTAL CHECK LIST

1. Design submissions for Approval
2. Shop Drawings.
3. Product Literature.
4. Master Label Certification

END OF SECTION 16610

SECTION 16660 - WIRING FOR EQUIPMENT

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The other Contract Documents complement the requirements of this Section. The General Requirements apply to the work of this Section.

1.02 SCOPE

A. Provide materials, labor and supervision necessary to install electric services for all equipment.

B. In general, the equipment to be wired shall include but not limit to the following:
   1. Mechanical Equipment
   2. Equipment furnished by Owner.
   3. Other equipment as required.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 INSTALLATION

A. Provide services and make final connections for motors and equipment. Make final connections except where notes on drawings state "rough-in only". Where final connections are not to be made, install outlet box, pull in conductors and leave an 8 inch pigtail for each conductor. Conductors shall be taped and appropriate cover plate installed over box.

B. Furnish safety disconnects for motors and equipment as needed, so as to make service complete to each item of equipment.

C. Prior to roughing-in conduit, the Contractor shall consult with Equipment suppliers, and shall verify with them the exact locations for rough-ins, and the exact size and characteristics of the services required, and shall obtain from the Equipment Suppliers a schedule of electrical loads for the equipment furnished by them. These schedules shall be used for verifying services, motor starters, disconnects, fuses and overload protection.

D. Changes required in the work, due to the Contractor's failure to comply with these requirements, shall be made by the Contractor at no additional cost to the Owner.

END OF SECTION 16660

SECTION 16725 – DISPATCH ALARM SYSTEM

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Provide all materials, equipment, labor special tools, services and supervision necessary to install complete the Fire Department personnel dispatch alarm system:

B. System equipment and installation shall be included in electrical scope and price, using Owner's preferred vendor.

C. Includes all work shown on drawing sheet T-201.

PART 2 - PRODUCTS

2.01 DISPATCH ALARM SYSTEM VENDOR

A. David Kaskie
Kaskie Electric LLC
502-558-1804

PART 3 - EXECUTION

3.01 INSTALLATION

A. All equipment power and wiring and grounding shall conform to the National Electrical Code and applicable local codes. Electronic equipment, antennas and antenna supports shall be grounded using a No. 3 solid copper wire.

B. Cable shall be adequately supported per NEC. The connectors shall be specifically designed for the type cable in use.

C. All equipment shall be suitably mounted in cabinets or otherwise solidly supported. Equipment suspended by its connection is not acceptable.

D. All outdoor connections shall be weatherproofed through approved methods. Cable entrances to the building shall be done in an approved manner.

3.02 TESTING

A. Upon completion of the system installation, it shall be the responsibility of the contractor to perform the necessary adjustments and balancing of all controls to insure proper system operation.

B. The contractor shall conduct an operating test for approval. The test shall be performed in the presence of the Architect/Engineer. The contractor shall furnish all equipment and personnel required for the tests.

C. The installer shall provide 4 hours of on-site instruction for Owner's personnel for all operation of equipment, provide and review operating manuals and supply technician as follow-up for operating questions during the first 30 days of use.

END OF SECTION 16725

SECTION 16851 - ELECTRIC DRYERS

PART 1 - GENERAL

1.01 WORK INCLUDED
A. Electric hand dryers as shown on Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE
Division 16 - Electrical Connections and Wiring

1.03 SUBMITTALS
A. Manufacturer's Literature:
1. Submit manufacturer's "cut sheets" for each item specified, showing installation details, and product information.

1.04 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.

1.05 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".

B. See Specifications Section 01630 - Product Options and Substitutions.

2.02 ELECTRIC HAND DRYERS (HIGH-VELOCITY TYPE)
A. Automatic, High-Velocity, White:
1. Provide one of the following approved products:
a. "Excel Dryer"; XLERATOR, #XL-W.
2. Epoxy painted cover, white finish.
3. Surface mounted, one-piece, heavy-duty, concealed mounting.
4. Infrared sensor operation.
5. 200 mph or 17,600 lfm minimum air velocity.
6. 120 volt electrical power connection. See Electrical and Division 16.
7. 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 16851

SECTION 16950 – LIGHTING SENSORS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish labor, materials, equipment, special tools, supervision and services required to provide and complete all lighting sensor work on this Project as indicated, noted, detailed and scheduled on the drawings and specified herein.

B. Generally includes the following:
1. Ceiling Sensors.
2. Wall Switch Sensors.
3. Wall Sensors.
4. Power Packs.

1.02 RELATED WORK SPECIFIED ELSEWHERE

Division 1 - General Requirements
Division 15 - Electrical
Section 16500 - Lighting

1.03 QUALITY ASSURANCE

A. All components shall be U.L Listed.

B. All components shall meet all applicable requirements of the NEC and State and local Codes.

C. All components shall be supplied by a single manufacturer that has been continuously involved in manufacture of lighting sensors for a minimum of (5) years.

D. All components shall offer a minimum (5) year warranty.

1.04 SUBMITTALS

A. Product Data:
1. Manufacturer's published catalog data, cutsheets, literature, specifications and installation instructions.
2. Indicate any load restrictions when used with electronic ballasts.

B. Shop Drawings:
1. Submit lighting plans indicating all sensor locations, types, orientations, etc.
2. Submit any interconnection diagrams per major subsystem showing proper wiring required.

PART 2 - PRODUCTS

2.01 CEILING SENSORS (DUAL TECHNOLOGY-STANDARD RANGE)

A. Provide one of the following approved products:
1. "Acuity Brands”; Sensorswitch #CM PDT 10.
2. “Watt Stopper”; #DT-300 Series, Standard Extended Range.
3. “Eaton/Greengate”; #OAC-DT-2000.

B. Description:
1. Generally intended for use in rooms and areas 1,000 s.f. and larger.
2. Shall provide line-of-sight passive infrared (PIR) detection of small motion in a 360 degree circular

pattern for detection of mobile occupants within the space and combine overlapping ultrasonic microphonics coverage for detection of occupants within the space either idle or located behind obstructions.
3. Low voltage.
4. Surface mounted to ceiling.
5. Shall not react to noise or ambient sound.

C. Options:
1. Provide “R” Low Voltage Relay. Only one relay required per zone.
2. Provide “D” Occupancy Controlled Dimming for all circuits requiring dimming fixtures. Only one sensor per zone required to have dimming output.

D. Color of device to be White.

2.02 CEILING SENSORS (DUAL TECHNOLOGY-REDUCED RANGE)

A. Provide one of the following approved products:
1. "Acuity Brands”; Sensorswitch #CM PDT 9.
2. “Watt Stopper”; #DT-300 Series, Optional High Density Lens.
3. “Eaton/Greengate”; #OAC-DT-1000.

B. Description:
1. Generally intended for use in rooms and areas less than 1,000 s.f.
2. Shall provide line-of-sight passive infrared (PIR) detection of small motion in a 360 degree circular pattern for detection of mobile occupants within the space and combine overlapping ultrasonic microphonics coverage for detection of occupants within the space either idle or located behind obstructions.
3. Low voltage.
4. Surface mounted to ceiling.
5. Shall not react to noise or ambient sound.

C. Options:
1. Provide “R” Low Voltage Relay. Only one relay required per zone.
2. Provide “D” Occupancy Controlled Dimming for all circuits requiring dimming fixtures. Only one sensor per zone required to have dimming output.

D. Color of device to be White.

2.03 WALL SWITCH SENSORS (DUAL TECHNOLOGY)

A. Provide one of the following approved products:
1. "Acuity Brands”; Sensorswitch #WSX PDT Series.
2. "Acuity Brands”; Sensorswitch #WSD PDT Series.
3. “Watt Stopper”; #DW-100 Series.
4. “Eaton/Greengate”; #ONW-D Series.

B. Description:
1. Shall provide line-of-sight passive infrared (PIR) detection of small motion in a 180 degree semi-circular pattern for detection of mobile occupants within the space and combine overlapping ultrasonic microphonics coverage for detection of occupants within the space either idle or located behind obstructions.
2. Capable for either 120 volt or 277 volt power.
3. Wall mounted within standard single-gang electrical box.
4. Shall not react to noise or ambient sound.

5. Field-selectable operation set per Owner's requirements.
6. Manual override buttons for field selectable option to change sensor operation from automatic sensor ON to manual ON.
7. Audible alert for impending shutoff.
8. Shall be capable of either Wiring To Neutral or Wiring To Ground (No Neutral).
9. Shall be capable of detection at a level 30" a.f.f. up to 300 s.f. and gross motion up to 1,000 s.f.

C. Color of device and wallplate to be selected from manufacturer's entire selection.

2.04 WALL SENSORS (DUAL TECHNOLOGY)

A. Provide one of the following approved products:
1. "Acuity Brands"; Sensorswitch #WVR PDT Series.
2. "Watt Stopper"; #DT-200 Series.

B. Description:
1. Shall provide line-of-sight passive infrared (PIR) detection of small motion in a 120 degree semi-circular pattern for detection of mobile occupants within the space and combine overlapping ultrasonic microphonics coverage for detection of occupants within the space either idle or located behind obstructions.
2. Capable for either 120 volt or 277 volt power.
3. Wall mounted flush to wall, typical.
If indicated away from wall surface, or requires an angular install, provide swivel mounting bracket.
4. Shall not react to noise or ambient sound.
5. Field-selectable operation set per Owner's requirements.
6. Audible alert for impending shutoff.

C. Color of device to be selected from manufacturer's entire selection.

2.05 SENSORS

A. General:
1. Shall be capable of operating normally with electronic ballasts, PL lamp systems, LED driver systems, and rated motor loads.
2. Shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.
3. Shall have UL rated plastic enclosures.

B. Operation:
1. Coverage shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioning or heating fans.
2. Shall have readily accessible and user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.
3. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall witch until sensor is replaced. This control shall be recessed to prevent tampering.
4. Where indicated or where operation is required as intended, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed, and Common outputs for use with HVAC control, Data Logging, BAS connectivity, Daylight Sensor connectivity, and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.06 POWER PACKS

A. Description:

1. Self-contained unit consisting internally of an isolated load switching control relay and a transformer to provide low-voltage power.
2. Universal voltage type.
3. Shall be rated for installation within ceiling plenums.
4. Provide units for low temperature or high humidity conditions where applicable.
5. Relay contacts shall be rated as follows:
   a. 13A or 15A Tungsten @120 VAC.
   b. 20A Ballast @120 VAC.
   c. 20A Ballast @277 VAC.
   d. 1HP Motor @120 VAC.
   e. 2HP Motor @250 VAC.
   f. Shall be available for 120, 220, 240, 277, and 347 VAC operation.

B. Manufacturer:
1. Manufacturer shall determine the appropriate power pack required for sensor or group of sensors, unless specific packs are selected. In that case, the manufacturer shall verify that the selected packs are applicable and most appropriate for intended installation.
2. Power packs shall be by the same manufacturer as the sensors, compatible with the sensors selected and provided as a complete and integral system.

C. Installation:
1. Provide power pack to serve each sensor or group of sensors as required.
2. Install concealed above ceiling or in adjacent room or space.
3. Control wiring between sensors and control units shall be Class II, 18-24 AWG, stranded UL Classified, PVC insulated or Teflon jacketed cable and plenum rated, where applicable.
4. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

PART 3 - EXECUTION

3.01 INSTALLATION

A. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations.

B. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s) for the intended use and occupancy.

C. The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to properly and completely cover the respective room.

D. It is the contractor's responsibility to arrange a pre-installation meeting with manufacturer's factory authorized representative, at owner's facility, to verify placement of sensors and installation criteria.

E. The time delay settings for certain applications or rooms may need to be field adjusted up to the 30 minute time delay. Coordinate this work with the Owner, temperature controls contractor, mechanical contractor, electrical contractor or technology contractor where needed (i.e. restroom exhaust fans etc.).

F. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or

interference of structural components.

G. The contractor shall also provide, at the Owner's facility, the training necessary to familiarize the Owner's personnel with the operation, use, adjustment, and problem solving diagnosis of the occupancy sensing devices and systems.

SUBMITTAL CHECKLIST

1. Product Data.
2. Shop Drawings.

END OF SECTION 16950