

Project Manual

City of Kerrville Athletic Complex Field House

Kerrville, Texas

October 21, 2016



10.21.16



PETER LEWIS
ARCHITECT + ASSOCIATES

MECHANICAL/ELECTRICAL/PLUMBING SPECIFICATIONS

FOR

City of Kerrville Athletic Complex Field House Kerrville, Texas 78028



MEP ENGINEER:



**MECHANICAL & ELECTRICAL
ENGINEERING, INC.**

1100 NW Loop 410, Suite 810
SAN ANTONIO, TEXAS 78213

210-342-3483
FAX 210-342-3641

TBPE NO.F-4137

PROJECT MANUAL

MEP SIGNATURE PAGE

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PROJECT DIRECTORY

Owner

City of Kerrville

701 Main Street
Kerrville, Texas 78028
830-257-8000

Architect

Peter W. Lewis Architect + Associates, PLLC

334 West Water Street
Kerrville, TX 78028
830-896-4220

Structural Engineer

Maxwell Engineering, PLLC

911 Panorama Dr.
Kerrville, TX 78028
830-895-0032

Mechanical, Electrical, Plumbing Engineer

ESA Mechanical and Electrical Engineering, Inc

1100 NW Loop 410, Ste. 810
San Antonio, TX 78213
210-342-3483

Civil

Hewitt Engineering Inc.

716 Barnett Street
Kerrville, TX 78028
830-895-0032

PROJECT DIRECTORY

Section 060

ADVERTISEMENT FOR BID

Sealed bids for **City of Kerrville Athletic Complex Field House** will be received by the office of the City secretary, City Hall, 701 Main Street, Kerrville, Texas 78028 until 3:00 p.m. on **Wednesday, November 30, 2016** and will then be publicly opened and read aloud in Council Chambers at City Hall.

The date and time of opening the bids shall be clearly marked on the outside of the sealed envelope. No bids will be accepted after 3:00 p.m. on the date of bid opening.

The bidding documents, plans, specifications, etc. may be examined by all bidders at the City of Kerrville Engineering Office, 200 Sidney Baker Street, Kerrville, Texas, 78028, 830-258-1170, or on the City's website www.kerrvilletx.gov and non-returnable, non-refundable copies may be purchased at Jackson Reprographics, 2500 Memorial Blvd. in Kerrville, TX (830-896-2679) & Lone Star Reprographics in San Antonio, TX (210-366-4808)

Each bid must be accompanied by **two copies of the City of Kerrville Construction Contract (Section 070 of the Contract Documents and Technical Specifications) with original signatures, as well as** a certified check, cashier's check, or Bid Bond payable to the City of Kerrville, Texas, in the amount of ten percent (10%) of the amount bid as a guarantee that the contract and bond will be entered into within ten (10) days after the award is made.

A Performance/Payment bond in the amount of one hundred percent (100%) of the total contract price will be required.

No bidder may withdraw his bid after the project is awarded by City Council.

A Pre-Bid Conference (non-mandatory) shall be held at 3:00 PM on November 22, 2016 at City Council Chambers, City Hall. **All questions regarding this project shall be directed in writing to Kyle Burow at Kyle.Burow@kerrvilletx.gov.**

Advertised:	<u>November 2, 2016</u> <u>November 9, 2016</u>
Pre-Bid Conference:	<u>November 22, 2016 3:00 PM</u>
Bid Opening:	<u>November 30, 2016 3:00 PM</u>
Bid Award	<u>December 13, 2016</u>

INSTRUCTIONS TO BIDDERS

- A. At Contractors cost, additional Bid Documents may be obtained from the Architect. All copies of Bid Documents shall remain the property of the Architect and shall be returned after bidding.
- B. Each bidder shall be responsible for fully examining the Bid Documents, visiting the jobsite, satisfying himself regarding all existing conditions and measurements, and shall include in his proposal an amount sufficient to cover all work as described in the documents. Should any bidder find discrepancies in the Bid Documents or should he be in doubt of their exact meaning, he should notify the Architect at once. The Owner may, at his option issue a written addendum correcting or clarifying the matter. Neither the Owner, nor the Architect will be responsible for oral instructions or for misinterpretations of the Bid Documents.
- C. The Owner reserves the right to issue addenda at any time prior to bid opening time. All such addenda become, upon issuance, a part of the Contract Documents. All addenda shall be acknowledged on the Bid Form.
- D. Prospective Bidders requiring further information or interpretation of the Bid Documents shall request such data in writing.
- E. To obtain approval to use an unspecified product, Bidders shall submit written requests at least 5 business days prior to the Bid due date in order to be considered. Requests shall clearly describe the product for which approval is asked. No proposed substitution will be considered less than 5 business days before bid due date.
- F. Clarification issues which arise too late to be included in a last addendum shall be handled as follows to assure uniformity in bidding:
 - 1. Bid the greater quantity, better quality, and more expensive work.
 - 2. Bid the interpretation that is most in keeping with the general nature and quality of the project.Attach to bid a written description of interpretation outlining issue in question and proposed solution.
- G. Answers to all questions, inquiries or requests for additional information, and construction document changes will be issued in the form of Addenda, and copies of each Addendum will be issued to all prospective bidders. During the bidding period, prospective bidders may be advised by Addendum of changes in the requirements of the Bid Documents. Failure to acknowledge receipt of any Addenda may invalidate a proposal as incomplete.
- H. The Owner reserves the right “not to respond” to clarification or interpretation requests received later than 5 business days prior to the date for receipt of bids, if responses cannot reasonably and fairly be transmitted to all bidders with sufficient time for review by bidders.
- I. The amount of the Base Bid must include, but not be limited to the following:
 - 1. All fees for royalties and patents.
 - 2. All temporary facilities as required.
 - 3. All Permits and required certifications.
- J. No bidder may withdraw his bid after the actual Bid Opening.

- K. The successful Bidder shall be required to enter into a Contract with the Owner, covering the entire work of the Bid, and must furnish to the Owner all certifications, insurance documents, and other requirements, within seven (7) days after issuance of a written Notice of Award of Contract or Letter of Intent by the Owner.
- L. Each bid must be accompanied by a certified check, cashier's check, or Bid Bond payable to the City of Kerrville, Texas, in the amount of ten percent (10%) of the amount bid as a guarantee that the contract and bond will be entered into within ten (10) business days after the award is made. Bid Bond may be provided on our Surety's Standard form.
- M. A Performance and Payment Bond, each in the amount of 100% of the total contract price will be required.
- N. The City of Kerrville (City) reserves the right to cancel or modify the terms of the Invitation to Bid and/or the Project at any times and for any reason preceding contract award and reserves the right to accept or reject any or all Proposals submitted pursuant to this Invitation to Bid. The City will post any such cancellation and/or modification on the City's website
- O. The City reserves the right to accept or reject any or all Proposals as a result of this request, to negotiate with all qualified sources, or to cancel, in part or its entirety, this Request for Proposal if found to be in the best interest of the City. All Proposals become the property of the City of Kerrville.
- P. The City shall not be responsible for any verbal communication between any employee of the City and any potential firm. Only written communications and statements will be considered.
- Q. Environmental assessment and any required abatement of existing construction will be performed by the City of Kerrville prior to commencement of construction.
- R. Acceptance of any Bid and execution of a Construction Contract is subject to project funding.
- S. Each Bid must be accompanied by:
1. Completed Construction Contract (two signed originals) **Make sure Bid submittals include two Contracts with original signatures.**
 2. AIA Document A305 –Contractor's Qualification Statement. (Two copies) List of similar Projects, Resumes of personnel.
 3. A list of similar projects completed by the General Contractor describing scope, project cost, complete date and current owner contact information.
 4. Identification and resumes of personnel to be directly involved in this project including Principal, Project Manager and Field Superintendent(s).
- T. Bids will be evaluated on Base Bid Amount and/or any combination of itemized Additive Alternates.
- U. Additional evaluation criteria will include:
1. Experience with similar building types.
 2. Experience with Public Buildings
 3. History of effective schedule and budget management for projects of similar scope
 4. Evidence of company's financial strength and stability.

- V. A \$500 City of Kerrville Contractor registration fee and \$5,000 bond for General Contractors not already registered with City of Kerrville is required. Registration fee is not required for Subs.
- W. This project is Tax Exempt.
- X. Union Labor, Prevailing Wages, or Certified Payroll on this project do not apply to this project.
- Z. Sub Contractor list as noted in Construction Contract shall be emailed to the Project Architect within 24 hours of submitting bid. List to include Mechanical, Electrical, and Plumbing.
- AA. 'No Construction will be permitted on Sundays and Holidays'. City of Kerrville holiday schedule for 2016-17 includes Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving, Christmas Eve, Christmas Day, New Years Day.
- BB. Building Permit fees for city owned projects are waived.
- CC. Water and sewer tap fees are **NOT** waived.
- DD. A proposal may not be modified, withdrawn or canceled by a Bidder for a period of sixty (60) days after the last date specified for receipt of bids.

Section 070

CITY OF KERRVILLE

CONSTRUCTION CONTRACT

This agreement made this day by and between the City of Kerrville, Texas, called "City," and the undersigned "Contractor" as follows:

1. THE WORK

The Contractor shall perform all the work as required by this contract for:

City of Kerrville Athletic Complex Field House

Reference Construction Plans signed and sealed by Peter Lewis Architect + Associates, PLLC dated [October 21, 2016](#) and approved by City of Kerrville on [December 13, 2016](#).

Summary of Work

The City of Kerrville Athletic Complex Field House will consist of sitework, concrete foundation, prefinished metal wall and roof panels over a pre-engineered metal building frame to include wall and roof insulation, millwork, aluminum and glass storefront systems, wood doors, steel doors and frames, finish hardware, drywall systems, suspended acoustic ceiling, painting, toilet partitions and accessories, electrical, lighting, automatic fire sprinkler system, HVAC and plumbing.

The following are incorporated herein:

- a. General Provisions
- b. Technical Specifications
- c. Addenda issued prior to receipt of Bid
- d. Plans
- e. Instructions to Bidders
- f. Proposal

Some of such documents may not be physically attached hereto but are on file at City Hall, and copies may be obtained upon request.

2. TIME

Construction substantial completion time will be **210** calendar days and 30 calendar days after for final completion from the date of written notice to proceed. Working days are defined in specification section 123.20. The project shall not be considered complete until all construction has been accepted and is operational and performing to its intended purpose. The Contractor's obligations to the project however, are not complete and retainage will not be released until all construction items are 100% complete to the satisfaction of local City of Kerrville officials.

3. LIQUIDATED DAMAGES

Liquidated damages are hereby established for work which is not substantially complete in the amount of Three Hundred Dollars (\$300.00) per working day for each working day after the date established in the Notice to Proceed. The City may offset any such liquidated damages against any sums from time to time due by the City to Contractor.

The completion time assumes that fifteen percent of the working days are "bad weather days," days on which the work cannot proceed; therefore, the time for completion shall not be extended on account of bad weather until the said number of assumed "bad weather days" has been exceeded.

The time for completion shall not be extended except by written memorandum executed by the Contractor and the City Engineer. Contractor shall make written application to the City not later than ten (10) days after the day, event, or cause claimed by Contractor to be a delay. Failure to make such written claim within such time shall result in a waiver by Contractor of an extension based on those particular days, events, or causes. If, for example, this contract assumes twenty (20) bad weather days and Contractor desired a one-day extension for the twenty-first day of rain, Contractor shall make a written claim not later than ten (10) days after the occurrence of such twenty-first day.

The said amount per day is not a penalty but an agreed amount of actual damages which are difficult to calculate. Such damages include loss of staff time, answering complaints by citizens who have been inconvenienced by the work, City Council time, loss of use, and other damages difficult to reasonably anticipate or calculate.

4. PAYMENTS

The City shall pay the Contractor ninety percent (90%) of the portion of Contract Sum properly allocable to labor, materials, and equipment incorporated in the Work and ninety-percent (90%) of the portion of the Contract Sum properly allocable to materials and equipment suitably stored at the site or at some other location agreed upon in writing, less the aggregate of previous payments made by the City, and, upon substantial completion of the entire Work, a sum sufficient to increase the total payments to ninety percent (90%) of the Contract Sum. All retainages from progress payments shall be withheld without liability for interest. Upon acceptance, the City shall make payment to Contractor such that one hundred percent (100%) of the Contract Sum has been paid.

The City may choose to award a contract for the amount of the base bid plus no or any combination of additive alternates.

5. LIABILITY INDEMNITY

THE CONTRACTOR AGREES TO INDEMNIFY, DEFEND, AND HOLD HARMLESS THE CITY OF KERRVILLE, TEXAS, AND ALL OF THEIR RESPECTIVE OFFICERS, AGENTS

AND EMPLOYEES FROM ALL SUITS, ACTIONS, CLAIMS, DAMAGES, PERSONAL INJURIES, LOSSES, PROPERTY DAMAGES, AND EXPENSES OF ANY CHARACTER WHATSOEVER, INCLUDING ATTORNEY'S FEES BROUGHT FOR OR ON ACCOUNT OF ANY INJURIES OF DAMAGES RECEIVED OR SUSTAINED BY ANY PERSON OR PROPERTY ON ACCOUNT OF ANY NEGLIGENT ACT OF THE CONTRACTOR, THE CITY OF KERRVILLE, TEXAS, OR ANY OF THEIR RESPECTIVE OFFICERS, EMPLOYEES, AGENTS, REPRESENTATIVES, OR SUBCONTRACTORS IN THE EXECUTION, SUPERVISION, AND OPERATIONS GROWING OUT OF OR IN ANY WAY CONNECTED WITH THE PERFORMANCE OF THIS AGREEMENT, WHETHER OR NOT THE ACT OR OMISSION OF THE CITY OR ANY OF THEIR RESPECTIVE OFFICERS, EMPLOYEES, OR AGENTS WAS THE SOLE PROXIMATE CAUSE OF THE INJURY OR DAMAGE OR A PROXIMATE CAUSE JOINTLY AND CONCURRENTLY WITH THE NEGLIGENCE OF THE CONTRACTOR OR ITS OFFICERS, EMPLOYEES, AGENTS, CONTRACTORS, OR SUBCONTRACTORS, IN THE EXECUTION, SUPERVISION AND OPERATIONS GROWING OUT OF OR IN ANY WAY CONNECTED WITH THE PERFORMANCE OF THIS AGREEMENT.

6. LIABILITY INSURANCE

Prior to the commencement of any work and not later than fifteen (15) days following the execution of this contract, the Contractor shall furnish the City copies of paid-up policies (to the City Risk Manager/City Hall) providing Liability and Workman's Compensation Coverage as follows minimum limits):

TYPE OF INSURANCE	LIMITS
a. Workman's Compensation covering all employees	Statutory
b. Employer's Liability	<u>\$100,000.00</u>
c. Comprehensive General Liability	
Bodily Injury & Property Damage (per occurrence)	<u>\$1,000,000.00</u>
Aggregate	<u>\$1,000,000.00</u>
(Premises/Operations Products/Completed Operations/Independent Contractors/Contractual Liability/Coverages may not be excluded). XCU must be supplied if any exposure.	
d. Business Automobile Liability covering owned vehicles, rented and non-owned vehicles and employee non-ownership	
Bodily Injury Property Damage (per occurrence)	<u>\$1,000,000.00</u>
Aggregate	<u>\$1,000,000.00</u>

The Commercial General Liability and the Automobile Liability policies shall name the City of Kerrville, Texas, as additional insured and all policies shall provide for a waiver of subrogation in favor of the City of Kerrville. The policy and any renewal certificate shall provide that the City be notified thirty (30) days prior to cancellation or modification of any coverage. Language to the effect that the company will "Endeavor" or "Attempt" to so notify the City of Kerrville is not sufficient. Renewal certificates must be received by the City at least ten (10) days prior to

any cancellation date. Policies will be in effect until final acceptance or cancellation of this contract, unless otherwise specified. The City may, at its sole option, terminate this agreement and file a claim on the Contractor's bid bond if the Contractor fails to deliver the required policies and certificates within 15 days after execution of this contract.

It shall be the responsibility of the Contractor to insure that all Subcontractors comply with the same insurance requirements as the said Contractor.

7. CASUALTY INSURANCE

In the event the work includes structures or buildings susceptible to damage by fire, windstorm, or other casualty, then the Contractor before being authorized to begin work shall furnish the City a duplicate original of an insurance policy naming the City of Kerrville as an additionally insured. Such insurance shall insure both the City of Kerrville and Contractor, during the term of the work, against loss by fire, windstorm, vandalism, theft, or other casualty. Such policy shall be in the total amount of this contract.

8. QUALITY OF WORK

All work shall be of good workmanship. Contractor shall comply with all applicable City of Kerrville Codes as well as all applicable professional and technical standards. Materials shall be of first quality.

9. CHANGES AND EXTRAS

No change of this Contract, whether for additional work, additional compensation, or other, shall be effective unless prior thereto a written change order has been authorized by the City Engineer. Employees of the City other than the City Engineer or Public Works Director do not have the authority to issue change orders.

10. ADDENDA

Contractor acknowledges the receipt of the following addenda:

- 1. Dated: _____ Acknowledged by: _____
- 2. Dated: _____ Acknowledged by: _____
- 3. Dated: _____ Acknowledged by: _____

11. CONTRACT SUM

Proposal: Contractor agrees to provide all labor, materials, and all incidentals necessary to complete "The Work" for the following Unit Prices:

TOTAL BID: _____

COMPLETED BY

DATE

(printed name)

(date)

(title)

(signature)

(company name)

SUBCONTRACTORS:

NAME	ADDRESS	PHONE	WORK TO BE PERFORMED
AIRCONDITIONING			
1.			
ELECTRICAL			
2.			
PLUMBING			
3.			

(Attach additional sheet if required)

INSURANCE AGENT

NAME	ADDRESS	PHONE	POLICY
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____

BONDING AGENT

NAME	ADDRESS	PHONE	POLICY
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____

Signed this _____ day of _____, 2016

Signature: _____

Attest: _____

Printed Name: _____

Secretary (if by Corporation)

Firm Name: _____

SEAL

Title: _____

Business Address:

Phone: _____

E-mail: _____

FAX: _____

ACCEPTED THIS _____

day of _____, 2016

By: _____

E.A. Hoppe, Deputy City Manager
City of Kerrville, Texas.

ATTEST: _____

Brenda G. Craig, City Secretary

CITY SEAL

APPROVED AS TO FORM:

Michael C. Hayes, City Attorney

Section 075

Payment Bond

KNOW ALL MEN BY THESE PRESENTS, that _____

of _____
hereinafter called the CONTRACTOR (Principal), and _____

a corporation duly organized and existing under and by virtue of the laws of the State of _____, hereinafter called the SURETY, and authorized to transact business within the State of Texas, as SURETY, are held and firmly bound unto THE CITY OF KERRVILLE, TEXAS, as OWNER (Obligee), in the sum of:

_____ DOLLARS (\$_____), lawful money of the United States of America, for the payment of which, well and truly be made to the OWNER, the CONTRACTOR and the SURETY bind themselves and each of their heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the CONTRACTOR has executed and entered into a certain Contract hereto attached, with the OWNER, dated _____, 2016
for:

NOW, THEREFORE, if the CONTRACTOR shall promptly make payment to all persons, firms, and corporations furnishing materials, labor, and services used directly or indirectly by the Contractor in the prosecution of the work, as provided in the Contract Documents, and shall pay the OWNER, all loss, damage, expense, costs, including attorneys fees which the OWNER may sustain by reason of failure or default on the part of CONTRACTOR, then this obligation shall be void; otherwise it shall be and remain in full force and effect.

PROVIDED, HOWEVER, that no final settlement between the OWNER and the CONTRACTOR shall abridge the right of any beneficiary hereunder, whose claim may be unsatisfied.

PROVIDED, FURTHER, that this BOND is executed pursuant to the provisions of Chapter 2253 of the Texas Government Code, as amended and all liabilities of this Bond shall be determined in accordance with the provisions of said Chapter to the same extent as if it were copied at length herein.

Venue for any disputes arising from or in any way related to the performance of the obligations set forth herein shall be in Kerr County, Texas.

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument this _____ day of _____, 2016, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

By _____ (Seal)

Attest

SURETY

By _____ (Seal)

Attest

ATTACH POWER OF ATTORNEY

Section 080

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS, THAT _____
of _____ hereinafter called the CONTRACTOR (Principal), and
_____ a corporation duly organized and existing under and by
virtue of the laws of the State of Texas, hereinafter called the SURETY, and authorized to transact
business within the State of Texas, as SURETY, are held and firmly bound unto THE CITY OF
KERRVILLE, TEXAS as OWNER (Obligee), in the sum of:

_____ DOLLARS (\$_____), lawful money of the United States of
America, for the payment of which, well and truly be made to the OWNER, the CONTRACTOR
and the SURETY bind themselves and each of their heirs, executors, administrators, successors, and
assigns, jointly and severally, firmly by these presents as follows:

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH THAT:

WHEREAS, the CONTRACTOR has executed and entered into a certain Contract hereto attached,
with the OWNER, dated _____, 2016, for:

NOW, THEREFORE, if the CONTRACTOR shall in all things perform all the terms and conditions
of the within and foregoing Contract as provided in the Contract Documents to be by such
CONTRACTOR performed, and shall honor all claims for defective work made within ONE year
after the completion and acceptance of the foregoing Contract, and shall pay the OWNER, all loss,
damage, expense, costs, including attorneys fees which the OWNER may sustain by reason of
failure or default on the part of CONTRACTOR, then this obligation shall be void; otherwise it shall
be and remain in full force and effect.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Chapter 2253 of
the Texas Government Code as amended and all liabilities of this Bond shall be determined in
accordance with the provisions of said Chapter to the same extent as if it were copied at length
herein.

PROVIDED, FURTHER, that the SURETY, for value received, hereby stipulates and agrees that no
change, extension of time, alterations, or addition to the terms of the Contract Documents or to the

work to be performed thereunder, shall in any way affect its obligation on this bond, and it does hereby waive notice of any such change, extension of time, alteration, or addition to the terms of the Contract Documents.

Venue for any disputes arising from or in any way related to the performance of the obligations set forth herein shall be in Kerr County, Texas.

IN WITNESS WHEREOF, the above parties bounded together have executed this instrument this _____ day of _____, 2016, the name and corporate seal of each corporate party being hereto affixed and those presents duly signed by its undersigned representative, pursuant to authority of its governing body.

CONTRACTOR

By _____ (Seal)

Its: _____ (Title)

Attest

SURETY

By _____ (Seal)
Attorney-in-Fact

ATTACH POWER OF ATTORNEY

Section 090

DESCRIPTION OF WORK

The project is located in Kerrville, Texas.

Following is a summary of work items included in the bid schedule:

City of Kerrville Athletic Complex Field House

Reference Construction Plans signed and sealed by Peter Lewis Architect + Associates, PLLC dated [October 21, 2016](#) and approved by City of Kerrville on [December 13, 2016](#).

The City of Kerrville Athletic Complex Field House will consist of a concrete foundation, pre-finished metal panels over a pre-engineered metal building frame. Interior to include drywall, suspended acoustic ceiling, ceramic tile, paint, millwork, storefront, wood doors, steel doors and frames, electrical, lighting, HVAC and plumbing.

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SECTION 00700 - GENERAL CONDITIONS - AIA A201

PART 1 - FORM OF GENERAL CONDITIONS

- 1.1 AIA DOCUMENT A201, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, 2007 EDITION, COMPRISES THE GENERAL CONDITIONS BETWEEN THE OWNER AND CONTRACTOR. A COPY IS ON FILE AT THE ARCHITECT'S OFFICE FOR VIEWING BY PROSPECTIVE BIDDERS.

PART 2 - SUPPLEMENTARY CONDITIONS

- 2.1 REFER TO THE SECTION 00800 - SUPPLEMENTARY CONDITIONS TO AIA A201, BOUND HERE, FOR AMENDMENTS TO THESE GENERAL CONDITIONS.

END OF DOCUMENT 00700

SECTION 01000 – GENERAL REQUIREMENTS**PART 1 - GENERAL**

- A. AIA Document A201, General Conditions of the Contract for Construction, 2007 Edition; comprise the general conditions between the Owner and the Contractor. A copy is on file at the Architect's office for viewing by prospective bidders.
- B. Contractor shall provide all items, materials, articles, operations or methods listed, mentioned shown or scheduled on the drawings and /or in these specification including labor, material, equipment and all incidentals necessary and required for the completion of the following Work. All work and areas adjacent to and affected by the Work shall be delivered to Owner in like-new condition prior to acceptance by Owner.
 - 1. Project: City of Kerrville Athletic Complex Field House
Kerrville, TX 78028
 - 2. Owner: City of Kerrville

The Work consists of: Concrete foundation, prefinished metal panels over a pre-engineered metal building frame. To include drywall, suspended acoustic ceiling, ceramic tile, paint, millwork, storefront, wood doors, steel doors and frames, electrical, lighting, HVAC and plumbing.

- C. Each bidder shall be responsible for fully examining the Bid Documents, visiting the jobsite, satisfying himself regarding all existing conditions and measurements, and shall include in his proposal an amount sufficient to cover all work as described in the documents.
- D. Contractor shall have full use of premises for construction operations, including use of Project site, during construction period. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.
- E. All Applicable State laws, Municipal ordinances and rules and regulations of all authorities having jurisdiction over the construction of the project shall apply to the Contract throughout and shall be deemed to be included in the contract including fees pertaining to such.
- F. In the event of errors or conflict between documents, only the Owner shall interpret, clarify or correct such conflict. All discrepancies shall be submitted to the architect for interpretation. If work which could be affected by such errors, conflict or discrepancy is proceeded upon without Owners clarification, correction, or interpretation, this work shall be made good, corrected or replaced at the Contractor's expense.
- G. Contractor assumes risks for damage or injury from whatever cause to property or persons used or employed on or in connection with the Work.

END OF SECTION 01000

SECTION 01100 - SUMMARY**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Project consists of a new City of Kerrville Athletic Complex Field House.
 - A. Project Location: The project is located in Kerrville, Texas, 78028
 - B. Owner: City of Kerrville
- B. Architect Identification: The Contract Documents, dated **October 21, 2016** were prepared by Peter Lewis Architect + Associates, 334 West Water Street, Kerrville, Texas 78028.
- C. The Work includes: The City of Kerrville Athletic Complex Field House will consist of a concrete foundation, prefinished metal panels over a pre-engineered metal building frame. To include drywall, suspended acoustic ceiling, ceramic tile, paint, millwork, storefront, wood doors, steel doors and frames, electrical, lighting, HVAC and plumbing.

1.3 CONTRACT

- A. Project will be constructed under a general construction contract.

1.4 USE OF PREMISES

- A. General: Contractor shall have partial use of premises for construction operations. Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project.

1.5 WORK UNDER OTHER CONTRACTS

- A. Separate Contract: Owner may award a separate contract for performance of certain construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
- B. Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

1.6 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish:
- B. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
- C. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule, unless otherwise noted.

- D. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
- E. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
- F. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
- G. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
- H. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
- I. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
- J. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
- K. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.

SPECIFICATION FORMATS AND CONVENTIONS

- B. Specification Format: The Specifications are organized into Divisions and Sections using the 16-division format and CSI/CSC's "MasterFormat" numbering system.
 - A. Section Identification: The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.
- C. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - A. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 - B. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
 - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

1.7 MISCELLANEOUS PROVISIONS

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

END OF SECTION 01100

SECTION 01140 - WORK RESTRICTIONS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 USE OF PREMISES

- A. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated.
1. Owner Occupancy: Allow for Owner occupancy of site.
 2. Driveways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.3 OCCUPANCY REQUIREMENTS

- A. Partial Owner Occupancy: Owner reserves the right to occupy and to place and install equipment in completed areas of building or site, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will provide, operate, and maintain mechanical and electrical systems serving occupied portions of building.
 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION (Not Used)**

END OF SECTION 01140

SECTION 01230 - ALTERNATES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A Schedule of Alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES –

A. *Additive Alternate #1 - Exterior Baseball Field*

B. END OF SECTION 01230

SECTION 01250 - CONTRACT MODIFICATION PROCEDURES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 MINOR CHANGES IN THE WORK

- A. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. 14 days after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change.
 - 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 5. Comply with requirements in Division 1 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.4 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
 - 3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Proposal cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 - 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Change Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01250

SECTION 01290 - PAYMENT PROCEDURES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
- B. Submit the Schedule of Values to Architect at earliest possible date but no later than fourteen (14) days before the date scheduled for submittal of initial Applications for Payment.
- C. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - f. Date of final acceptance or substantial completion.
 - g. Contract time, in days.
 - h. Contract time Remaining, in days.
 - i. Percent of contract time used.
 - 2. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value.
 - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
 - 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide several line items for principal subcontract amounts, where appropriate.
 - 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

- a. Differentiate between items stored on-site and items stored off-site. Include evidence of insurance or bonded warehousing for materials stored offsite.
6. Allowances: Provide a separate line item in the Schedule of Values for each allowance.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
8. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Times: The date for each progress payment shall be as agreed to by the Owner and Contractor, but no more than one (1) per month.
- D. Payment Application Forms: AIA Document G702 and AIA Document G703 Continuation Sheets.
- E. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Architect. One copy shall include waivers of lien and similar attachments if required.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
- G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 1. Submit partial waivers on each item for amount requested, before deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final or full waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Waiver Delays: Submit each Application for Payment with Contractor's waiver of mechanic's lien for construction period covered by the application.
 - a. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Submittals Schedule (preliminary if not final).
 5. List of Contractor's staff assignments.
 6. Copies of building permits.
 7. Certificates of insurance and insurance policies.
 8. Performance and payment bonds.
 9. Data needed to acquire Owner's insurance.
- I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.
 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 9. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01290

SECTION 01310 - PROJECT MANAGEMENT AND COORDINATION**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General project coordination procedures.
 - 2. Coordination Drawings.
 - 3. Administrative and supervisory personnel.
 - 4. Project meetings.

1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in various Sections of the Specifications to ensure efficient and orderly installation of each part of the Work.

1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
- B. Staff Names: Submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1.5 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fifteen (15) days

after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.

1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; manufacturers; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing.
 - d. Designation of responsible personnel.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for processing Applications for Payment.
 - g. Distribution of the Contract Documents.
 - h. Submittal procedures.
 - i. Preparation of Record Documents.
 - j. Use of the premises.
 - k. Responsibility for temporary facilities and controls.
 - l. Parking availability.
 - m. Office, work, and storage areas.
 - n. Equipment deliveries and priorities.
 - o. First aid.
 - p. Security.
 - q. Progress cleaning.
 - r. Working hours.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction. Advise Architect of scheduled meeting dates.
- D. Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.
1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.

- 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site utilization.
 - 8) Temporary facilities and controls.
 - 9) Work hours.
 - 10) Hazards and risks.
 - 11) Progress cleaning.
 - 12) Quality and work standards.
 - 13) Change Orders.
 - 14) Documentation of information for payment requests.
3. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
- a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01310

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Submittals Schedule.
 - 2. Contractor's Construction Schedule.

1.3 SUBMITTALS

- A. Submittals Schedule: Submit three (3) copies of schedule. Arrange the following information in a tabular format:
 - 1. Submittal number, arrange and list in group following location in specifications.
 - 2. Specification Section number and title.
 - 3. Name of subcontractor.
 - 4. Description of the Work covered.
 - 5. Contractor's Construction Schedule: Submit three (3) printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.

1.4 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in sequence appearing in Technical Specifications. Include scheduled submittal date, allow time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 - 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 - 2. Initial Submittal: Submit concurrently with bar-chart.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work.
- C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- D. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
 - 1. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.

2.3 CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit horizontal bar-chart-type construction schedule within seven days of date established for the Notice to Proceed
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities. Include a cash requirement prediction based on indicated activities.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities

- A. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01320

SECTION 01330 - SUBMITTAL PROCEDURES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require approval. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - 3. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
 - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Concurrent Review: Where concurrent review of submittals by Architect's consultants, Owner, or other parties is required, allow 21 days for initial review of each submittal.
 - 3. Direct Transmittal to Consultant: Where the Contract Documents indicate that submittals may be transmitted directly to Architect's consultants, provide duplicate copy of transmittal to Architect. Submittal will be returned through Architect, before being returned to Contractor.
 - 4. If intermediate submittal is necessary, process it in same manner as initial submittal.

5. Allow 15 days for processing each resubmittal.
 6. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Identification: Place a permanent label or title block on each submittal for identification.
- F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- G. Coordinate paragraph and subparagraphs below with office policy. Marking numerous copies of submittals can be time consuming.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
- J. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Number of Copies: Submit three copies of each submittal, unless otherwise indicated. Architect will return two copies. Mark up and retain one returned copy as a Project Record Document.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. PDF electronic files where possible.
 2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 x 36 inches.
 4. Number of Copies: Submit copies of each submittal, as follows:
 - a. Submittal: Submit one correctable, translucent, reproducible print and two blue- or black-line print. Architect will return the reproducible print.
- D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."
- E. Samples: Prepare physical units of materials or products, including the following:
1. Samples for Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 2. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, that show full range of color and texture variations expected.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- F. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Contractor's Construction Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation."
- C. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- D. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- E. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- C. On advice of counsel, select appropriate terms for action stamp and insert term and explanation of each action taken in subparagraph below. See Evaluations.
- D. Informational Submittals: Architect will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- E. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

END OF SECTION 01330

SECTION 01400 - QUALITY REQUIREMENTS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical example assemblies to illustrate finishes and materials. Mockups are used to verify selections made under Sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples. Mockups establish the standard by which the Work will be judged.
- D. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.4 SUBMITTALS

- A. Reports: Prepare and submit certified written reports that include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.

5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Ambient conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.
- B. Mockups: Build mockups as described:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 2. Demonstrate the proposed range of aesthetic effects and workmanship.
 3. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 4. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 5. Demolish and remove mockups when directed, unless otherwise indicated.

1.6 QUALITY CONTROL

- A. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- B. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- C. Testing Agency Responsibilities: Cooperate with Architect, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
- D. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01400

SECTION 01410 - TESTING LABORATORY SERVICES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division-1 Specification Sections apply to work specified in this Section.

1.2 PROCEDURE**A. Owner's Testing Laboratory:**

An independent testing laboratory will be selected and furnished by the Owner to inspect and test the materials and methods of construction as hereinafter specified for compliance with the specification requirements of the Contract Documents and to perform such other specialized technical services as required by the Owner or his representative. All testing lab services shall be paid for by the owner.

1.3 QUALIFICATIONS OF TESTING LABORATORY

- A. The Testing Laboratory selected shall meet the basic requirements of ASTM E329 "Standard of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction", and shall submit to the Contractor, Owner, Architect, and Engineer, a copy of the report of inspection of their facilities made by the Materials Reference Laboratory of the National Bureau of Standards during the most recent tour of such inspections, and shall submit a memorandum stating steps taken to remedy all deficiencies reported by this inspection.
- B. The Testing Laboratory selected shall meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, as published by the American Council of Independent Laboratories.
- C. Testing machines shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards or accepted values of natural physical constants. The Testing Laboratory shall submit a copy of certificate of calibration made by an accredited calibration agency.
- D. Tests and inspections shall be conducted in accordance with specified requirements, and if not specified, in accordance with the applicable standards of the American Society for Testing and Materials or other recognized and accepted authorities in the field.

1.4 AUTHORITIES AND DUTIES OF THE LABORATORY**A. Attending Preconstruction Conferences:**

The Owner's Testing Laboratory shall obtain and review the project plans and specifications with the Architect and Engineer as soon as possible prior to the start of

construction. The Owner's Laboratory shall attend preconstruction conferences with the Architect, Engineer, Project Manager, General Contractor, and Material Suppliers as required to coordinate materials inspection and testing requirements with the planned construction schedule. The Owner's Laboratory will participate in such conferences throughout the course of the project.

B. Outline Testing Program:

The Owner's Testing Laboratory shall be responsible for outlining a written detailed testing program conforming to the requirements as specified in the Contract Documents and in consultation with the Owner, Contractor, Architect, and Engineer. The testing program shall contain an outline of inspections and tests to be performed with reference to applicable sections of the specifications or drawings and a list of personnel assigned to each portion of the work. Such testing program shall be submitted to the Owner, Contractor, Architect, and Engineer five weeks in advance of the start of construction so as not to delay the start of construction. It shall be the Testing Laboratory's responsibility that such program conforms to the requirements of the Specifications and drawings and falls within the budget for testing laboratory services. If the allocated budget is not sufficient to cover the services as outlined in the Specifications, it shall be the responsibility of the Laboratory to notify the Contractor, Architect, Engineer, and Owner so that the Laboratory services can be modified accordingly prior to the start of construction. Furthermore, the Testing Laboratory shall monitor its expenditures throughout the course of the job and notify immediately the Owner, Contractor, Architect, and Engineer, of any significant deviation from the planned testing program and budget.

C. Cost Proposal:

The Testing Laboratory's proposal to the Owner shall contain the outlined testing program based on a unit price basis for tests and inspections and on an hourly basis for personnel. A total estimated price shall also be submitted.

D. Cooperation with Design Team:

The Laboratory shall cooperate with the Architect, Engineer, and Contractor and provide qualified personnel promptly on notice.

E. The Laboratory shall perform the required inspections, sampling, and testing of materials as specified under each section and observe methods of construction for compliance with the requirements of the Contract Documents.

F. Inspections Required by Government Agencies:

The Testing Laboratory shall perform all inspections and submit all reports and certifications as required by all government agencies.

G. Notification of Deficiencies in the Work:

The Laboratory shall notify the Architect, Engineer, and Contractor first by telephone and then in writing of observed irregularities and deficiencies of the work and other conditions not in compliance with the requirements of the Contract Documents.

H. Reports:

1. Information on Reports:

The Laboratory shall submit copies of all reports of inspections and tests promptly and directly to the parties named below. All reports shall contain at least the following information:

- a. Project Name
- b. Date report issued
- c. Testing Laboratory name and address
- d. Name and signature of inspector
- e. Date of inspection and sampling
- f. Date of test
- g. Identification of product and Specification section
- h. Location in the project
- i. Identification of inspection or test
- j. Record of weather conditions and temperature (if applicable)
- k. Results of test regarding compliance with Contract Documents.

2. Copies:

The Laboratory shall send certified copies of test and inspection reports to the following parties:

- a. 2 copies to the Owner or his representative
- b. 2 copies to the General Contractor
- c. 1 copy to the Architect
- d. 1 copy to the Engineer of responsibility
- e. 1 copy to the Supplier of the material tested
- f. 1 copy to the Mechanical Engineer

3. Certification by Notary Public:

Upon completion of the job, the Testing Laboratory shall furnish to the Owner, Architect, and Engineer of responsibility, a statement certified by a Notary Public that all required tests and inspections were made in accordance with the requirements of the Contract Documents.

I. Accounting:

The Testing Laboratory shall be responsible for separating and billing costs attributed to the Owner and cost attributed to the Contractor.

J. Obtaining Product and Material Certifications:

The Testing Laboratory shall be responsible for obtaining all product and material certifications from manufacturers and suppliers as specified in the Specifications.

K. Limitations of Authority:

The Testing Laboratory is not authorized to revoke, alter, relax, enlarge upon, or release any requirements of the Specifications or to approve or accept any portion of the work or to perform any duties of the General Contractor and his Subcontractors.

1.5 CONTRACTORS RESPONSIBILITY

A. Cooperation with Design Team:

The owner shall pay for all testing lab services. The Contractor shall cooperate with laboratory personnel, provide access to the work, and to manufacturers operations.

B. Furnishing Samples:

The Contractor shall provide to the laboratory representative, samples of materials proposed for use in the work in quantities sufficient for accurate testing as specified.

C. Furnishing Casual Labor, Equipment and Facilities:

The Contractor shall furnish casual labor, equipment, and facilities as required for sampling and testing by the Laboratory and otherwise facilitate all required inspections and tests.

D. Advance Notice:

The Contractor shall be responsible for notifying the Testing Laboratory sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.

E. Payment for Substitution Testing:

The Contractor shall arrange with the Testing Laboratory and pay for any additional samples and tests above those required by the Contract Documents as requested by the Contractor for his convenience in performing the work.

F. Payment for Retesting:

The Contractor shall pay for any additional inspections, sampling, testing, and retesting as required when initial tests indicate work does not comply with the requirements of the Contract Documents.

G. Payment by Contractor:

The Contractor shall furnish and pay for the following items:

1. Soil survey of the locations of borrow soil materials, samples of existing soil materials, and delivery to the Testing Laboratory.

2. Concrete mix designs as prepared by his concrete supplier.
3. Concrete coring, tests of below strength concrete, and load tests, if ordered by the Owner, Architect, or Engineer.
4. Certification of reinforcing steel mill order.
5. Certification of structural steel mill order.
6. Certification of Portland cement, lime, and flyash.
7. Certification of welders.
8. Tests, samples and mock-ups of substitute material where the substitution is requested by the Contractor and the tests are necessary in the opinion of the Owner, Architect, or Engineer to establish equality with specified items.
9. Any other tests when such cost are required by the Contract Documents to be paid by the Contractor.

H. Notification of Source Change:

The Contractor shall be responsible for notifying the Owner, Architect, Engineer, and Testing Laboratory when the source of any material is changed after the original tests or inspections have been made.

I. Tests for Suspected Deficient Work:

If in the opinion of the Owner, Architect, or Engineer any of the work of the Contractor is not satisfactory, the Contractor shall make all tests that the Owner, Architect, or Engineer deem advisable to determine its proper construction. The owner shall pay all costs if the tests prove the questioned work to be satisfactory.

1.6 PAYMENT OF TESTING LABORATORY

The Owner will pay for all Laboratory services for testing of materials for compliance with the requirements of the Contract Documents. The Contractor will pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents and all other items as specified in these Specifications.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCOPE OF WORK

The work to be performed by the Testing Laboratory shall be as specified in this Section of the Specification and the contract drawings, and as determined in meetings with the Contractor, Owner, Architect, and Engineer.

3.2 EARTHWORK

A. Tests of Proposed Fill Material:

The Testing Laboratory shall conduct a survey of the Contractor's proposed location of borrow soil materials and shall establish the suitability of any proposed fill material by determining the required engineering properties. Soil tests shall include soil classification by the Atterberg Limit Tests ASTM D4138, and grain size determined by ASTM D422 "Particle Size Analysis of Soils."

B. Moisture Density Relationship for Natural and Fill Materials:

The Testing Laboratory shall provide one optimum moisture density curve for each type of soil, natural, imported fill, or on-site fill, encountered in subgrade and fills under building slabs and paved areas. Curves shall be generated in accordance with ASTM D1557 "Test Methods for Moisture Density Relationships of Soils and Soil Aggregate Mixtures."

C. Quality Control Testing Required During Construction:

1. Inspection of Subgrade and Fill:

The Owner's Testing Laboratory shall inspect and approve the following subgrades and fill layers before further construction work is performed thereon:

- a. Paved Areas and Building Slab Subgrade: Make at least one field density test of the natural subgrade for every 2500 square feet of paved area or building slab but in no case less than three tests. In each compacted fill layer or lift, make one field density test for every 2500 square feet of building slab on paved area but in no case less than three tests.

2. Field Density Tests:

Field Density Tests shall be run according to ASTM D1556 "Density of Soil in Place by the Sand Cone Method," ASTM D2167 "Density of Soil in Place by the Rubber Balloon Method" or ASTM D2922 "Density of Soil and Soil Aggregate in Place by Nuclear Methods" or ASTM D698 "Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort" as applicable.

3. Acceptance Criteria:

The result of field density tests by the Owner's Testing Laboratory will be considered satisfactory if the average of any three consecutive tests has a value not greater than 2 percent below the required density.

4. Report Copies:

The Testing Laboratory shall submit all moisture density curves and results of field density tests to the parties specified earlier in this section.

5. Additional Testing:

If reports by the Owner's Testing Laboratory indicate field densities lower than specified above, additional tests will be run by the Owner's Testing Laboratory with at least the frequencies scheduled above on recompacted fill and/or natural subgrade. The Testing Laboratory shall notify the Contractor on a timely basis for any required retesting so as not to delay the work. The costs of such tests shall be borne by the Contractor.

3.3 REINFORCING STEEL

A. Visual Inspection:

The Testing Laboratory shall inspect the rebar to determine the following:

1. The bars shall be free from injurious defects and shall have a workman-like finish.
2. Deformations shall be of the proper sizes, shapes, and spacing as detailed in ASTM A-615.
3. The bars shall not have excessive rust and/or pelting.
4. The bars shall not have any unusual twists or bends.

B. Identified Stock:

Where job material is taken from bundles as delivered from the mill, is properly identified as to heat number and is accompanied by mill and analysis test reports, provided an affidavit is given from the Supplier to the Testing Laboratory that the materials conform with the requirements of the ASTM specification as listed on the structural drawings. In case of controversy, the procedure as stipulated below for unidentified stock shall be followed.

C. Unidentified Stock:

For all unidentified stock, the Testing Laboratory shall secure samples of the reinforcing steel bars at the time of inspection. The samples shall confirm to the following:

1. The sample shall include 2 bars for each ten tons or fraction thereof, of each bar size, heat number, and manufacturer being shipped.
2. The sample bars shall be a minimum of 24 inches in length and should be identical to the material being shipped.

The Testing Laboratory shall tag each of the steel bundles with the Laboratory identification tag and appropriately mark the samples corresponding to the steel being inspected and shipped. The fabricator will supply shipping lists showing the weight of each bar size in the shipment. The sample reinforcing bars shall be returned to the Testing Laboratory for tensile strength tests and bend tests according to AEM A615. Bend tests will not be required for #14 and #18 bars.

3.4 CONCRETE MATERIALS AND POURED IN PLACE CONCRETE

A. Concrete Mix Designs:

The Contractor shall submit for approval by the Engineer and Owner's Testing Laboratory at least 15 days prior to the start of construction, concrete mix designs for each class of concrete indicated on the structural drawings and in the Specifications. The Contractor shall not begin work until the applicable mix design has been approved.

1. The Contractor acting in conjunction with his Concrete Supplier and the Testing Laboratory shall submit in writing with his mix designs, whether the concrete is to be proportioned by either of the following methods as outlined in ACI 318:
 - a. Field Experience Method
 - b. Laboratory Trial Batch Method

When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301 and ACI 211. When Laboratory trial batches are used to select concrete proportions, the procedure as outlined in ACI 318 shall be followed. Prepare test specimens in accordance with ASTM C192 and conduct strength tests in accordance with ASTM C39.

2. Required types of concrete and compressive strengths shall be as indicated on the Structural Drawings and as specified in the various sections of the Specifications.
3. All mix designs shall state the following information:
 - a. Mix design number or code designation by which the Contractor shall order the concrete from the Supplier
 - b. Structural member for which the concrete is designed (i.e. columns, shear walls, footings, etc.)
 - c. Type of concrete whether normal weight or lightweight
 - d. 28 day compressive strength
 - e. Aggregate type, source, size, gradation, fineness modulus
 - f. Cement type and brand
 - g. Fly ash type and brand (if any)
 - h. Admixtures including air entrainment, water reducers, accelerators, and retarders
 - i. Slump
 - j. Proportions of each material used
 - k. Water cement ratio and maximum allowable water content
 - l. Method by which the concrete is intended to be placed (bucket, chute, or pump)

4. Concrete Suppliers Record of Quality Control:
The concrete supplier's past record of quality control shall be used in the design of the concrete mixes to determine the amount by which the average concrete strength f_{cr} should exceed the specified strength f'_c as outlined in ACI 318. If a suitable record of test results is not available, the average strength must exceed the design strength by 1200 PSI as specified in ACI 318. After sufficient data becomes available from the job, the statistical methods of ACI 214 may be used to reduce the amount by which the average strength must exceed f'_c as outlined in ACI 318.
5. Admixtures:
 - a. Admixtures to be used in concrete shall be subject to the approval of the Engineer and Testing Laboratory.
 - b. Quantities of admixtures to be used shall be in strict accordance with the manufacturers instructions.
 - c. Admixtures containing chloride ions shall not be used in prestressed concrete, in concrete containing galvanized or aluminum embedments, or in metal deck floors or roofs.
 - d. Air entraining admixtures shall conform to "Specification for Air Entraining Admixtures for Concrete" ASTM C260.
 - e. Water reducing admixtures, retarding admixtures, accelerating admixtures, water reducing and retarding admixtures, and water reducing and accelerating admixtures shall conform to "Specification for Chemical Admixtures for Concrete" ASTM C494.
 - f. Fly ash or other pozzolons, used as admixtures, shall conform to "Specification for Fly Ash and Raw or Calcined Natural Pozzolons for use in Portland Cement Concrete" ASTM C618. Obtain mill test reports for approval. Maximum flyash content shall be 20%.
 - g. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities of admixtures as required to maintain quality control.
6. Slump Limits:
Unless shown otherwise on the structural drawings, proportion and design mixes to result in concrete slump at the point of placement as follows:
 - a. Ramps and Sloping surfaces - $3" \pm 1"$
 - b. Foundation concrete - $4\text{-}1/2" \pm 1\text{-}1/2"$
 - c. All other concrete - $4" \pm 1"$

When increased workability, pumpability, lower water-cement ratio, shrinkage reduction, or permeability reduction is required, then a superplasticizer admixture shall be considered for use. The maximum slump with the use of superplasticizers shall be 8 inches unless approved otherwise by the Architect/Engineer and Testing Laboratory.

Any deviation from these values (such as concrete design to be pumped) shall be submitted to the Engineer and Testing Laboratory for approval.

7. Adjustments of Concrete Mixes:

Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such mix design adjustments shall be provided at no additional cost to the Owner. Any adjustments in approved mix designs including changes in admixtures shall be submitted in writing to the Engineer and Testing Laboratory for approval prior to field use.

8. Shrinkage:

All concrete shall be proportioned for a maximum allowable unit shrinkage of 0.03% at 28 days as determined by ASTM C 157.

9. Chloride Ion Content:

A written submittal shall be made with each mix design proposed for use on the project that the chloride ion content from all ingredients including admixtures will not exceed the limits specified in the Cast-In-Place section of the Specifications.

B. Concrete Test Cylinders by the Testing Laboratory:

1. Molding and Testing:

Cylinders for strength tests shall be molded and Laboratory cured in accordance with ASTM C31 "Method of Making and Curing Concrete Test Cylinders in the Field" and tested in accordance with ASTM C39 "Method of Testing for Compressive Strength of Cylindrical Concrete Specimens".

2. Field Samples:

Field samples for strength tests shall be taken in accordance with ASTM C172 "Method of Sampling Fresh Concrete".

3. Frequency of Testing:

Each set of test cylinders shall consist of a minimum of four standard test cylinders. A set of test cylinders shall be made according to the following frequency guidelines:

- a. One set for each class of concrete taken not less than once a day.
- b. Mat Foundation: One set for each 250 cubic yards or fraction thereof.
- c. Floors: One set for each 150 cubic yards or fraction thereof but not less than one set for each 5000 square foot of floor area.
- d. All Other Concrete: A minimum of one set for each 150 cubic yards or fraction thereof.
- e. No more than one set of cylinders at a time shall be made from any single truck.
- f. If the total volume of concrete is such that the frequency of testing as specified above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.
- g. The above frequencies assume that one batch plant will be used for each pour. If more than one batch plant is used, the frequencies cited above shall apply for each plant used.

The cylinders shall be numbered, dated, and the point of concrete placement in the building recorded. Of the four cylinders per set break one at seven days, two at 28 days, and one automatically at 56 days only if either 28 day cylinder break is below required strength.

4. Cylinder Storage Box:

The Contractor shall be responsible for providing a protected concrete cylinder storage box at a point on the jobsite mutually agreeable with the Testing Laboratory for the purpose of storing concrete cylinders until they are transported to the Laboratory.

5. Transporting Cylinders:

The Testing Laboratory shall be responsible for transporting the cylinders to the Laboratory in a protected environment such that no damage or ill effect will occur to the concrete cylinders.

6. Information on Concrete Test Reports:

The Testing Laboratory shall make and distribute concrete test reports after each job cylinder is broken. Such reports shall contain the following information:

- a. Truck number and ticket number
- b. Concrete Batch Plant
- c. Mix design number
- d. Accurate location of pour in the structure
- e. Strength requirement
- f. Date cylinders made and broken
- g. Technician making cylinders
- h. Concrete temperature at placing
- i. Air temperature at point of placement in the structure
- j. Amount of water added to the truck at the batch plant and at the site and whether it exceeds the amount allowed by the mix design

- k. Slump
- l. Unit weight
- m. Air content
- n. Cylinder compressive strengths with type of failure if concrete does not meet Specification requirements. Seven day breaks are to be flagged if they are less than 60% of the required 28 day strength. 28 day breaks are to be flagged if either cylinder fails to meet Specification requirements.

C. Other Required Tests of Concrete by the Testing Laboratory (unless noted otherwise):

- 1. Slump Tests:
Slump Tests (ASTM C143) shall be made at the beginning of concrete placement for each batch plant and for each set of test cylinders made.
- 2. Air Entrainment:
Air entrainment (ASTM C233) tests shall be made at the same time slump tests are made as cited above.
- 3. Concrete Temperature:
Concrete temperature at placement shall be measured at the same time slump tests are made as cited above.
- 4. Chloride Ions:

The Contractor shall have the laboratory verify in a written submittal with the mix designs that the chloride ion concentration will not exceed the limits specified.

Tests shall be run for each class of concrete according to AASHTO Designation T 260-82 Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials to determine that the maximum chloride ion content does not exceed the limits stated in the concrete section of the specifications. One test shall be run for each set of cylinders specified to be taken for each class of concrete.

D. Evaluation and Acceptance of Concrete:

- 1. Strength Test:
A strength test shall be defined as the average strength of two 28 day cylinder breaks from each set of cylinders.
- 2. Quality Control Charts and Logs:
The Owner's Testing Laboratory shall keep the following quality control logs and charts for each class of concrete containing more than 2,000 cubic yards. The records shall be kept for each batch plant and submitted on a weekly basis with cylinder test reports:
 - a. Number of 28 day strength tests made to date.

- b. 28 day strength test results containing the average of all strength tests to date, the high test result, the low test result, the standard deviation, and the coefficient of variation.
- c. Number of tests under specified 28 day strength.
- d. A histogram plotting the number of 28 day cylinders versus compressive strength.
- e. Quality control chart plotting compressive strength test results for each test.
- f. Quality control chart plotting moving average for strength where each point plotted is the average strength of three previous test results.
- g. Quality control chart plotting moving average for range where each point plotted is the average of 10 previous ranges.

3. Acceptance Criteria:

The strength level of an individual class of concrete shall be considered satisfactory if both of the following requirements are met:

- a. The average of all sets of three consecutive strength tests equal or exceed the required f'_c .
- b. No individual strength test (average of two 28 day cylinder breaks) falls below the required f'_c by more than 500 PSI.

If either of the above requirements is not met, the Testing Laboratory shall immediately notify the Engineer by telephone. Steps shall immediately be taken to increase the average of subsequent strength tests.

E. Investigation of Low Strength Concrete Test Results:

1. Contractor Responsibility for Low Strength Concrete:

If any strength test of Laboratory cured cylinders falls below the required f'_c by more than 500 psi, the Contractor shall take steps immediately to assure that the load carrying capacity of the structure is not jeopardized.

2. Nondestructive Field Tests:

The Testing Laboratory shall under the direction of the Engineer perform nondestructive field tests of the concrete in question using Swiss Hammer, Windsor Probe, or other appropriate methods as approved by the Engineer and report the results in the same manner as for cylinder test reports.

3. Core Tests:

If the likelihood of low strength concrete is confirmed and computations indicate that the load carrying capacity of the structure has been significantly reduced, tests of cores by the Testing Laboratory, drilled from the area in question under the direction of the Engineer, will be required in accordance with ASTM C42

"Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". In such case, three cores shall be taken for each strength test more than 500 PSI below required f'c. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 48 hours and tested wet. The Contractor shall fill all holes made by drilling cores with an approved drypack concrete.

4. Acceptance Criteria for Core Tests:

Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85% of f'c and if no single core is less than 75% of f'c. If approved by the Engineer, locations of erratic core strengths may be retested to check testing accuracy.

5. Load Test:

If the above criteria are not met and the structural adequacy remains in doubt, the Engineer may order a load test as specified in ACI 318 for the questionable portion of the structure.

6. Strengthening of the Structure or Demolition:

If the structural adequacy of the affected portion of the structure remains in doubt, the Engineer may order the structure to be strengthened by an appropriate means or demolished and rebuilt.

7. Cost of Investigations for Low Strength Concrete:

The costs of all investigations of low strength concrete shall be borne by the Contractor.

F. Jobsite Inspection:

The scope of the work to be performed by the inspector on the jobsite shall be as follows:

1. Verify that air temperatures at the point of placement in the structure are within acceptable limits defined above prior to ordering of concrete by the Contractor.
2. Inspect concrete upon arrival to verify that the proper concrete mix number, type of concrete, and concrete strength is being placed at the proper location.
3. Inspect plastic concrete upon arrival at the jobsite to verify proper batching. Observe mix consistency and adding of water as required to achieve target slumps in mix designs. Record the amount of water added and note if it exceeds that allowed in the mix design. The responsibility for adding water to trucks at the jobsite shall rest only with the Contractor's designated representative. The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.

4. Obtain concrete test cylinders.
5. Perform slump tests and air entrainment tests.
6. Record information for concrete test reports.
7. Verify that all concrete being placed meets job Specifications. Report concrete not meeting the specified requirements and immediately notify the Contractor, Batch Plant Inspector, Contractor, Architect, Engineer, and Owner.
8. Pick up and transport to Laboratory, cylinders cast the previous day.
9. Check concrete placing techniques to determine that concrete deposited is uniform and that vertical drop does not exceed six feet.
10. The jobsite inspector shall report any irregularities that occur in the concrete at the jobsite or test results to the Contractor, Architect, Owner, and Engineer.

G. Causes for Rejection of Concrete:

The Contractor shall reject all concrete delivered to the site for any of the following reasons:

1. Wrong class of concrete (incorrect mix design number).
2. Air temperature:

Air temperature limits shall be as follows:

- a. Cold Weather: Air temperature must be 40°F and rising
- b. Hot Weather: Air temperature must be cooler than 100°.

Concrete may be placed at other air temperature ranges only with approval of the job inspector for the Testing Laboratory or other duly appointed representative.

3. Concrete with temperatures exceeding 95°F may not be placed in the structure.
4. Air contents outside the limits specified in the mix designs.
5. Slumps outside the limits specified in the mix designs.
6. Excessive Age:
Concrete shall be discharged within 90 minutes of plant departure or before it begins to set if sooner than 90 minutes unless approved by the Laboratory job inspector or other duly appointed representative.

The Contractor is responsible that all concrete placed in the field is in conformance to the Contract Documents.

H. Concrete Batch Trip Tickets:

All concrete batch trip tickets shall be collected and retained by the Contractor. Compressive strength, slump, air, and temperature tests shall be identified by reference to a particular trip ticket. All tickets shall contain the information specified in ASTM C 94. Each ticket shall also show the amount of water that may be added in the field for the entire batch that will not exceed the specified water cement ratio for the design mix. The Contractor and Testing Laboratory shall immediately notify the Architect/Engineer and each other of tickets not meeting the criteria specified.

3.5 STRUCTURAL STEEL

A. Contract Obligations:

1. Owner Responsibility:

The Owner shall pay for all initial field inspections and tests as required during the fabrication and erection of the structural steel.

2. Contractor Responsibility:

The Contractor shall arrange with the Owner's Testing Laboratory for the certification of all shop and field welders. Each bolting crew and welder shall be assigned an identifying symbol or mark and all shop and field connections shall be so identified so that the inspector can refer back to the person or crew performing the work. The costs of all retesting of material or workmanship not in conformance with the Contract Documents shall be borne by the Contractor. The Fabricator and Erector shall provide the Laboratory inspector with access to all places where work is being done. A minimum of 24 hours notification shall be given prior to commencement of work. The Contractor shall provide the Testing Laboratory with the following:

- a. A complete set of Architect/Engineer reviewed shop and erection drawings including all revisions and addenda.
- b. Cutting lists, order sheets, material bills, shipping bills, and mill test reports.
- c. Information as to time and place of all rollings and shipment of material to shops.
- d. Representative sample pieces requested for testing.
- e. Full and ample means and assistance for testing all material.
- f. Proper facilities, including scaffolding, temporary work platforms, hoisting facilities, etc., for inspection of the work in the mills, shop and field.

3. Testing Laboratory Responsibility:

Inspection of field work shall be completed promptly so that corrections can be made without delaying the progress of the work. Inspections shall be performed by qualified technicians with a minimum of two years experience in structural steel testing and inspection. All inspection personnel shall be certified in

accordance with AWS QC-1. The Testing Laboratory shall provide test reports of all shop and field inspections. Shop test reports shall include shop welders certifications. All test reports shall indicate types and locations of all defects found during inspection, the measures required and performed to correct such defects, statements of final approval of all welding and bolting of shop and field connections, and other fabrication and erection data pertinent to the safe and proper welding and bolting of shop and field connections. In addition to the parties listed in this Specification the Fabricator and Erector shall receive copies of all test reports.

4. Rejection of Material or Workmanship:

The Owner, Architect, Engineer, and Testing Laboratory reserve the right to reject any material or workmanship not in conformance with the Contract Documents at any time during the progress of the work. However, this provision does not allow waiving the obligation for timely, in sequence inspections.

B. Mill Tests of Structural Steel:

1. Mill Order Steel:

The Fabricator shall furnish certified mill test reports and an affidavit stating that the structural steel furnished meets the requirements of the grade specified on the structural drawings for all mill order steel. In case of controversy, test of the material according to ASTM A6 or A568 as applicable made by the Contractor's Testing Laboratory with certified test reports paid for by the Contractor shall be made to verify conformity with ASTM standards. Tests shall be made for each 10 tons of material used unless approved otherwise by the Engineer.

2. Local Stock Steel:

Materials taken from stock by a Fabricator for use for structural purposes must be of a quality at least equal to that required by the ASTM specifications applicable to the classification covering the intended use. Certified mill test reports shall be accepted as sufficient record of the quality of materials carried in stock by the fabricator provided the stock steel can be identified by heat or melt numbers. In case of controversy, tests by the Contractor's Testing Laboratory with certified reports as specified for mill order steel shall be required.

3. If tests are required, test specimens shall be taken by the Contractor under the direction of the Testing Laboratory and shall be machined by the Testing Laboratory to dimensions as required by the applicable ASTM standards.

C. Field Inspections and Tests:

The Owner's Testing Laboratory shall provide inspection in the field for a period of time as determined in consultation with the Architect, Owner, and Engineer prior to the start of erection in a timely manner so as to not delay the start of erection. The following tests and inspections shall be made:

1. Obtain the planned erection procedure, and review with the Erectors supervisory personnel.
2. Check the installation of base plates for proper leveling, grout type, and grout application.
3. Verify field welding procedures and obtain welder certificates. (Including welding of cold formed framing.)
4. Check steel as received in the field for possible shipping damage, workmanship, and piece marking.
5. Check plumbness and frame alignment as erection progresses.
6. Check joint preparation and fit up, backing strips, and runout plates for welded moment connections and column splices.
7. Check preheating to assure proper temperature, uniformity, and thoroughness through the full material thickness.
8. Review welding sequence.
9. Visually inspect all field welding for size, length, and quality.
10. Perform nondestructive examination services for various weldments of field erection determined in consultation with the Structural Engineer prior to the start of erection. The Laboratory shall furnish a qualified technician with the necessary equipment to perform radiographic, ultrasonic, magnetic particle, or dye penetrant inspection as required for the item being tested and other duties as outlined for shop inspection in the previous Section. Unless specified otherwise, check all partial and complete penetration welds in connections of beams, girders, columns, and braces. Check 10% of connections with fillet welds. Visual inspection is required for all welds.
11. Check calibration of impact wrenches used in field bolted connections.
12. Check high strength friction field bolted connections according to inspection procedures outlined in the "Specification for Structural Joints Using ASTM A325 or A490 Bolts." Unless specified otherwise, test 10% of the bolts, but not less than two bolts, selected at random in each connection. If any bolt is found to be improperly tightened, test all bolts in the connection. Visually inspect all bearing type bolts to verify that the bolts are snug tight.
13. Visually inspect the welding of metal deck to the structure.
14. Perform field tests on 10% of completed shear connectors in each beam according to inspection procedures outlined in AWS D1.1

The costs of repairing all defective welds and the costs of retesting by the Owner's Testing Laboratory shall be borne by the Contractor. If removal of a backing strip is required by the Owner's Testing Laboratory to investigate a suspected weld defect, such cost shall be borne by the Contractor.

3.6 NON-SHRINK GROUT FOR BASE PLATES

A. Compressive Strength Tests:

Compressive strength of grout shall be determined by testing four cubes two inches in dimension according to the requirements of ASTM C109 "Compressive Strength of Hydraulic Cement Mortars." Each strength test shall be the average of two 28 day strengths. Test one cube at 7 days, 2 at 28 days, and one at 56 days only if either 28 day test is low.

B. Frequency of Testing:

One set of cubes (4 cubes) shall be made for every ten base plates and bearing plates or fraction thereof but not less than one set for each day's operation. One set of cubes shall be made for each day's operation of grouting wall panels.

3.7 MASONRY:

A. Prism Tests

1. Scope:

Prism tests shall be made for each class of masonry (hollow masonry, grouted masonry, or composite masonry) on the project using an assembly of actual masonry units, mortar, and grout (if specified) as planned in the work.

2. Compressive Strength Test:

Test shall be run according to the requirements of ASTM E447 "Test Methods for Compressive Strength of Masonry Prisms." Each strength test shall be defined as the average of three test prisms from the same class of masonry.

3. Frequency of Testing:

- a. Interior Non-Load Bearing Walls: One strength test shall be run for each 5,000 square feet of wall or fraction thereof.
- b. Exterior Walls and All Loadbearing Walls: One strength test shall be run for each 5,000 square feet of wall area but not less than one strength test for each day's operation for each class of wall. An additional test should be run whenever there is a change in mortar or grout proportions.

B. Mortar Test:

1. Scope:

Mortar cube test shall be required only for loadbearing masonry construction (hollow or grouted) for the purpose of measuring uniformity of field batching.

2. Compressive Strength Test:

Tests shall be run according to the requirements of ASTM C780 "Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry." Each strength test shall be defined as the average of three cube specimens two inches in dimension tests at 28 days.

3. Frequency of Testing:

One strength test shall be run for each 5,000 square feet of wall but not less than one strength test for each day's operation for each class of wall. An additional test should be run whenever there is a change in mix proportions.

C. Grout Tests:

1. Scope:

Grout prism tests shall be required for all grout used in masonry construction.

2. Compressive Strength Test:

Specimens shall be 3½"x3½"x7" or 3"x3"x6" cast in molds with a flat nonabsorbent base and masonry units having the same moisture condition as those being laid forming the sides of the specimens. Specimens shall be capped according to ASTM C617 and tested according to ASTM C39. Each strength test shall be defined as the average of two 28 day prisms.

3. Frequency of Testing:

Four grout prisms shall be made for each 30 cubic yards of grout but not less than one set for each day's operation. An additional set should be made whenever the grout mix is changed. One prism shall be tested at 7 days, two at 28 days, and one at 56 days only if either 28 day test is low.

D. Experience Requirement:

Field inspection of masonry construction by the Owner's Testing Laboratory as herein described shall be performed by qualified technicians with a minimum of ten years experience in masonry testing and inspection.

E. Field Inspection Requirements:

The duties and responsibilities of the Testing Laboratory Inspector in the field shall be as follows:

1. Review and become familiar with project drawings and specifications.

2. Review all masonry materials used in the field for conformance to project specifications. This shall include masonry units, mortar, grout, portland cement, masonry cement, sand, lime, horizontal joint reinforcement, ties, masonry anchoring devices, to the structure, and control joint strips.
3. Review proper horizontal joint reinforcement size and spacing. Review size and spacing of wall ties.
4. Review proper masonry construction practices for mortar including requirements for high and low lift grouting. Check conformance with hot and cold weather construction requirements.
5. Verify proper mortar batching proportions.
6. Confirm clean outs for high lift grouting.
7. Verify construction tolerances.
8. Review and confirm installation of reinforcing steel size, spacing, and splices in all walls, lintels, pilasters, and columns.
9. Confirm number and size of dowels in the foundation to walls and columns.
10. Take mortar, grout, and prism samples as specified.

3.8 OPEN WEB STEEL JOISTS

A. Scope:

The Owner's Testing Laboratory shall perform inspection of open web steel joists in the fabricating plant and in the field as herein described.

B. Obtaining Manufacturer's Product Certification:

The Contractor shall obtain product certification for open web steel joists and joist girders as required by the Specifications.

C. Inspection in the Field:

The duties of Field Inspector shall be as follows:

1. Inspect joists for damage during shipment.
2. Verify proper bearing of joist supports.
3. Verify camber requirements of joists arriving in the field.
4. Confirm bridging size and location.
5. Confirm attachment of joists to supports (welding or bolting).

6. Confirm bolting of joists to supports at column lines as required by OSHA requirements.
7. Verify that no joists have been damaged during erection.

END OF SECTION 01410

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Sanitary facilities.
 - 3. Heating and cooling facilities.
 - 4. Ventilation.
 - 5. Electric power service.
 - 6. Lighting.
 - 7. Telephone service: provide Fax machine and E-mail.
- C. Security and protection facilities include, but are not limited to, the following:
 - 1. Environmental protection.
 - 2. Stormwater control.
 - 3. Tree and plant protection.

1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:
 - 1. Owner's construction forces.
 - 2. Occupants of Project.
 - 3. Architect.
 - 4. Testing agencies.
 - 5. Personnel of authorities having jurisdiction.
- B. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.
- C. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Field Offices: Mobile units with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.

PART 3 - EXECUTION**3.1 INSTALLATION, GENERAL**

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
- B. Water Service: Use of Owner's existing water service facilities will be permitted, subject to the following: as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
 - 1. Facilities are cleaned and maintained in a condition acceptable to the Owner.
 - 2. Temporarily metered separate.
 - 3. Provide rubber hoses as necessary to serve Project site.
 - 4. Contractor shall bear the cost of repair resulting from construction activity damage.
- C. Sanitary Facilities: Provide temporary toilets.
- D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity.
- E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity.
- F. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period.
- G. Lighting: Provide temporary lighting as required for construction operations.
- H. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations.
- B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion.

3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Termination and Removal: Remove each temporary facility when need for its service has ended, no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION 01500

SECTION 01600 - PRODUCT REQUIREMENTS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
- B. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- C. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.4 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
- B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use Attached form at the end of this section.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.

- f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
- i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
- j. Cost information, including a proposal of change, if any, in the Contract Sum.
- k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
- l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
- C. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
- D. Protect stored products from damage.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: Forms are included with the Specifications. Prepare a written document using appropriate form properly executed.
 3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 3. Where products are accompanied by the term "as selected," Architect will make selection.
 4. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 6. Or Equal: Products that are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," shall mean as approved by the Architect.

2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 2. Requested substitution does not require extensive revisions to the Contract Documents.
 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 4. Substitution request is fully documented and properly submitted.
 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 7. Requested substitution is compatible with other portions of the Work.
 8. Requested substitution has been coordinated with other portions of the Work.
 9. Requested substitution provides specified warranty.
 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.

2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01600

SECTION 01700 - EXECUTION REQUIREMENTS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. General installation of products.
 - 4. Progress cleaning.
 - 5. Starting and adjusting.
 - 6. Protection of installed construction.
 - 7. Correction of the Work.

PART 2 - PRODUCTS (Not Used)**PART 3 - EXECUTION**

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

3.2 PREPARATION

- A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than three (3) days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect promptly.
- B. Maintenance: General Contractor shall determine and maintain layout control points and lines. Responsibility for this work shall not be delegated to a Subcontractor.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of eight (8) feet in spaces without a suspended ceiling.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

3.6 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

- D. Installed Work: Keep installed work clean.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.

3.7 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.8 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.9 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 01700

SECTION 01710 – CLEANING UP**PART 1 - GENERAL**

1.1 GENERAL

- A) Maintain premises free from accumulations of waste, debris, and rubbish caused by construction operations.
- B) At completion of Work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials; and clean all sight-exposed surfaces. Leave project clean and ready for occupancy.

1.2 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- A) Cleaning up required for specific trades or work - Specification Section pertaining to that trade or work.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A) Codes and Standards - Applicable Federal, State and Local codes and regulations relative to environmental safety regulations.
- B) Hazards Control - Store volatile waste in covered metal containers and remove from premises daily. Prevent accumulation of wastes which create hazardous conditions.
- C) Pollution Control - Conduct clean-up and disposal operations to comply with local ordinances and anti-pollution laws.
 - 1) Burning or burying of rubbish and waste materials on the project site is prohibited.
 - 2) Disposal of volatile fluid wastes (such as mineral spirits, oil or paint thinner) in storm or sanitary sewer systems or into streams or waterways is prohibited.

PART 2 - MATERIALS

2.1 CLEANING MATERIALS

- A) Use only cleaning materials recommended by manufacturer of surface to be cleaned.
- B) Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.1 DURING CONSTRUCTION

- A) Oversee cleaning and ensure that building and grounds are maintained free from accumulations of waste materials and rubbish.
- B) Sprinkle dusty debris with water to control accumulation of dust.
- C) At not less than every day during progress of work, cleanup work areas and access, and dispose of waste materials, rubbish, and debris.
- D) Provide dump containers and locate on site for collection of waste materials, rubbish and debris.
- E) Do not allow waste materials, rubbish and debris to accumulate and become an unsightly or hazardous condition.
- F) Removed waste materials, rubbish, and debris from site, and legally dispose of at public or private dumping areas off Owner's property.
- G) Keep streets and access to site free of rubbish and debris.

- H) Remove trash after 4:30 p.m.
- I) Lower waste materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.
- J) Vacuum clean interior building areas when ready to receive finish painting and continue vacuum cleaning on an as-needed basis until building is ready for acceptance or occupancy.
- K) Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.2 FINAL CLEANING

- A) Employ skilled workmen for final cleaning.
- B) Remove grease, mastics, adhesives, dust, dirt, stains, labels, fingerprints, and other foreign materials from sight-exposed interior and exterior surfaces.
- C) Repair, patch and touch up marred surfaces to match adjacent finishes.
- D) Broom clean paved surfaces; rake clean other surfaces of grounds.
- E) Ventilating System:
 - 1) Clean permanent filters and replace disposable filters if units were operated during construction.
 - 2) Clean ducts, blowers and coils if air conditioning units were operated without filters during construction.
- F) Wash and shine glazing and mirrors.
- G) Polish glossy surfaces to a clear shine.
- H) Clean and polish finish hardware.
- I) Sweep and buff resilient floors and base.
- J) Vacuum floor areas scheduled to receive floor finish by others.
- K) Vacuum carpeted floor areas.
- L) Replace broken or scratched glass with new glass.
- M) Prior to final completion, or occupancy, conduct an inspection of sight-exposed interior and exterior surfaces, and all work areas, to verify that entire work is clean.

END OF SECTION 01710

SECTION 01732 - SELECTIVE DEMOLITION**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Demolition and removal of selected portions of a building or structure.
2. Demolition and removal of selected site elements.
3. Repair procedures for selective demolition operations.

- B. Related Sections include the following:

1. Division 1 Section "Summary" for use of the premises and phasing requirements.
2. Division 1 Section "Construction Progress Documentation" for preconstruction photographs taken before selective demolition.
3. Division 1 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
4. Division 1 Section "Cutting and Patching" for cutting and patching procedures for selective demolition operations..
5. Division 15 Sections for demolishing, cutting, patching, or relocating mechanical items.
6. Division 16 Sections for demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- B. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.
 - 1. Coordinate with Owner, who will establish special procedures for removal and salvage.

1.5 SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- B. Inventory: After selective demolition is complete, submit a list of items that have been removed and salvaged.
- C. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.
- D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional Engineer Qualifications: Comply with Division 1 Section "Quality Requirements."
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
- F. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
 - 1. Inspect and discuss condition of construction to be selectively demolished.

2. Review structural load limitations of existing structure.
3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

1.7 PROJECT CONDITIONS

- A. Maintain access to existing walkways, and other adjacent occupied or used facilities.
 1. Do not close or obstruct walkways, or other occupied or used facilities without written permission from authorities having jurisdiction.
- B. Owner assumes no responsibility for condition of areas to be selectively demolished.
 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
 2. Before selective demolition, Owner will remove the following items:
 - a. Refer to Demolition Plans.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
 1. Hazardous materials will be removed by Owner before start of the Work.
 2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.
- D. Hazardous Materials: Hazardous materials are present in building to be selectively demolished. A report on the presence of hazardous materials is on file for review and use. Examine report to become aware of locations where hazardous materials are present.
 1. Hazardous material remediation is specified elsewhere in the Contract Documents.
 2. Do not disturb hazardous materials or items suspected of containing hazardous materials except under procedures specified elsewhere in the Contract Documents.
- E. Storage or sale of removed items or materials on-site will not be permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
 - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Utility Requirements: Refer to Division 15 and 16 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.3 PREPARATION

- A. Dangerous Materials: Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.

- B. **Site Access and Temporary Controls:** Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.
 2. Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction.
 3. Protect existing site improvements, appurtenances, and landscaping to remain.
 4. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
- C. **Temporary Facilities:** Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- D. **Temporary Enclosures:** Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- E. **Temporary Partitions:** Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
- F. **Temporary Shoring:** Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.

3.4 POLLUTION CONTROLS

- A. **Dust Control:** Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.

1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
 2. Wet mop floors to eliminate trackable dirt and wipe down walls and doors of demolition enclosure. Vacuum carpeted areas.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- C. Cleaning: Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain adequate ventilation when using cutting torches.
 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 9. Dispose of demolished items and materials promptly.
 10. Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- B. Existing Facilities: Comply with building manager's requirements for using and protecting elevators, stairs, walkways, loading docks, building entries, and other building facilities during selective demolition operations.

- C. Removed and Salvaged Items: Comply with the following:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to Owner's storage area to be designated by Owner.
 5. Protect items from damage during transport and storage.
- D. Removed and Reinstalled Items: Comply with the following:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.
- E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- F. Concrete: Demolish in small sections. Cut concrete to a depth of at least **3/4 inch (19 mm)** at junctures with construction to remain, using power-driven saw. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition. Neatly trim openings to dimensions indicated.
- G. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- H. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- I. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- J. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.
- K. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with Division 1 Section "Cutting and Patching."
- C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
 - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- E. Floors and Walls: Where walls or partitions that are demolished extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
 - 2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
 - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Burning: Burning of demolished materials will be permitted only at designated areas on Owner's property, providing required permits are obtained. Provide full-time monitoring for burning materials until fires are extinguished.
- D. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.
- E. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION 01732

SECTION 01770 - CLOSEOUT PROCEDURES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Project Record Documents.
 - 3. Operation and maintenance manuals.
 - 4. Warranties.
 - 5. Instruction of Owner's personnel.
 - 6. Final cleaning.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
 - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 - 2. Advise Owner of pending insurance changeover requirements.
 - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8. Complete startup testing of systems.
 - 9. Submit test/adjust/balance records.
 - 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 11. Advise Owner of changeover in heat and other utilities.
 - 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 - 13. Complete final cleaning requirements, including touchup painting.
 - 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

- B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.
 3. The Contractor shall bear additional Architect/Engineer cost of the second reinspection and subsequent reinspections until Final Acceptance.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training videotapes.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work is completed or corrected.
 2. The Contractor shall bear additional Architect/Engineer cost of the second reinspection and subsequent reinspections until Final Acceptance.

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.6 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.
- B. Record Drawings: Maintain and submit one set of blue- or black-line white prints of Contract Drawings and Shop Drawings.
 - 1. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
 - a. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
 - b. Accurately record information in an understandable drawing technique.
 - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
 - d. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
 - 2. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
 - 3. Mark important additional information that was either shown schematically or omitted from original Drawings.
 - 4. Note Construction Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
 - 5. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications. Mark copy to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Note related Change Orders, Record Drawings, and Product Data, where applicable.
- D. Record Product Data: Submit one copy of each Product Data submittal. Mark one set to indicate the actual product installation where installation varies substantially from that indicated in Product Data.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, Record Drawings, and Record Specifications, where applicable.

- E. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

1.7 OPERATION AND MAINTENANCE MANUALS

- A. Assemble a complete set of operation and maintenance data indicating the operation and maintenance of each system, subsystem, and piece of equipment not part of a system. Include operation and maintenance data required in individual Specification Sections and as follows:
 - 1. Operation Data:
 - a. Emergency instructions and procedures.
 - b. System, subsystem, and equipment descriptions, including operating standards.
 - c. Operating procedures, including startup, shutdown, seasonal, and weekend operations.
 - d. Description of controls and sequence of operations.
 - e. Piping diagrams.
 - 2. Maintenance Data:
 - a. Manufacturer's information, including list of spare parts.
 - b. Name, address, and telephone number of Installer or supplier.
 - c. Maintenance procedures.
 - d. Maintenance and service schedules for preventive and routine maintenance.
 - e. Maintenance record forms.
 - f. Sources of spare parts and maintenance materials.
 - g. Copies of maintenance service agreements.
 - h. Copies of warranties and bonds.
- B. Organize operation and maintenance manuals into suitable sets of manageable size. Bind and index data in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, with pocket inside the covers to receive folded oversized sheets. Identify each binder on front and spine with the printed title "OPERATION AND MAINTENANCE MANUAL," Project name, and subject matter of contents.

1.8 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

- C. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **Cleaning Agents:** Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 DEMONSTRATION AND TRAINING

- A. **Instruction:** Instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

3.2 FINAL CLEANING

- A. **General:** Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. **Cleaning:** Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
- C. **Pest Control:** Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. **Comply with safety standards for cleaning.** Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 01770

**SECTION 02880
PERMEABLE BASE FOR SYNTHETIC TURF SYSTEM**

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Conform to the General Conditions, Supplementary Conditions, and Division 1.

1.2 DESCRIPTION OF WORK

- A. The scope of the work shall include, earthwork, sub-grade, drainage work, permeable base rock, concrete curbing and turf anchor. All work shall include, but is not limited to all materials and labor to design, permit, furnish and install.

1.3 RELATED SECTIONS

- A. Section 02890 – Synthetic Turf system

1.4 RELATED DOCUMENTS (References and Standards)

- A. ASTM – American Society of Testing Materials
 1. A 615: Standard Specifications for Deformed and Plain Billet Steel Bars for Concrete Reinforcements.
 2. ASTM C29: Test for Unit Weight and Voids in Aggregate
 3. ASTM C 94: Standard Specification for Ready-Mixed Concrete.
 4. ASTM C150: Specifications for Portland Cement (Types I and II)
 5. ASTM C 171: Standard Specification for Sheet Materials for Curing Concrete.
 6. ASTM C 309: Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 7. ASTM C 494: Standard Specification for Chemical Admixtures for Concrete.
 8. ASTM C 595: Specification for Blended Hydraulic Cements
 9. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 10. ASTM D 1751: Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non extruding and Resilient Bituminous Types).

1.5 CONTRACTOR QUALIFICATION REQUIREMENTS

- A. Synthetic turf base contractors foreman must have 5 years experience building synthetic turf bases. Contractor shall provide a complete list of the past 5 projects in which the foreman held the lead position. Contractor must supply the following information for each listed project: foreman's role in those projects, contact information, including phone numbers.
- B. Synthetic turf base contractor shall supply a complete list of the past 10 projects in which the Contractor's company was involved in specifics comparable to this project. Contractor must supply the following information for each listed project: Owner, contact information, including phone numbers.

1.6 NOT USED

1.7 SUBMITTALS

- A. Contractor shall supply (6) copies of all testing data, and product materials data, concrete mix design, rebar shop drawings if applicable, and any product cut sheets, and performance data.
- B. Contractor shall submit a sample of stone and a sieve and permeability analysis test to the Owner and Architect for approval prior to delivery to the site. The sieve and permeability analysis must be by an independent testing lab and to the sieve sizes specified below. The sieve tests must be made of the EXACT material to be used and performed no more than 21 days prior to submittal for review.
- C. Contractor shall supply (6) six copies of all maintenance and operations manuals to the owner prior to substantial completion of the project
- D. Sample Warranty of all applicable materials and products.
- E. Submit a concrete job mix formula to the Owner and Architect at least 15 days prior to delivery of concrete to the job site.
- F. Concrete job mix formula shall be submitted on form 1, attached.
- G. Submit complete rebar schedule, bar details and erection drawings in accordance with ACI 315.

1.8 QUALITY ASSURANCE (Test and Inspection Requirements)

- A. Notification - No site work shall be performed without notifying synthetic turf system installer, Owner and Architect at least 48 hours prior to commencement of work.
- B. All base rock construction shall be completed by means of fully automated laser controlled LGP excavation equipment for all subgrades and finish grades.

- C. After completion of installation of permeable rock base, notify Owner and Architect for inspection of finish grade. Contractor to have a laser set up and links rod available for Owner and Architect to walk the finish grade and approve prior to any work on elastic layer to begin.
- D. Contractor to notify Synthetic Turf Contractor, Owner and Architect 72 hours prior to completion of finish grade to have their representative on site to approve and or reject the finish grade work. Turf Contractor to have final approval of finish grade.
- E. Use only concrete plants complying with the ASTM C 94 or NRMCA minimum standards.
- F. Contractor shall have sub-grade and top-stone compaction testing completed and paid by the contractor. Supply the owner with copies of the testing and inspection reports.

1.9 DELIVERY, STORAGE AND PROTECTION

- A. Permeable aggregate shall be delivered to site in proper trucks so as to not segregate product.
- B. Aggregate shall be delivered with proper moisture content and must be protected for weather events that will wash out the fines in the product.
- C. Properly protect aggregate and sub-grades to be in compliance with approved TESC requirements of governing jurisdiction.

1.10 FIELD VERIFICATION

- A. A representative, designated by the turf system manufacturer, will be present intermittently to observe the Contractor's operation, to perform tests and measurements, and to adjust the work as necessary to meet field conditions. Such observations, tests, measurements and work adjustments shall not alter the requirements of the drawings or specifications nor imply any superintendence or control of the Contractor's operation, nor warranty the Contractor's work. Relative compaction of compacted soils will be determined in general accordance with the American Society for Testing and Materials (ASTM) Test Methods D1557 (modified proctor) and D2167, D2922, or D3017.

1.11 WARRANTY

- A. Contractor shall supply a one year warranty on all labor and workmanship of the base, concrete, drainage, and materials required to install all items within the specifications, and shown on schematic drawings.
- B. All product warranties by all suppliers or product manufacturers shall be included and provided within the maintenance and operations manual.

PART 2 -PRODUCTS

2.1 BASE BID CONCRETE MATERIALS

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PERMEABLE CRUSHED ROCK BASE
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A. Concrete in a Freshly-Mixed and Unhardened State

1. Concrete in a freshly-mixed and unhardened state shall comply with ASTM C 94 except as expressly and specifically modified and designated herein. Modifications and designations shall be as follows:

- a. Cement (See ASTM C 94 4.1.1) shall contain not more than 0.80 percent total alkalies (Na₂O_0.658 K₂O)
- b. Pozzolan shall conform to ASTM C 618 Class F or Class C. A certificate of Compliance shall be provided on request. Total weight of Pozzolan shall not exceed 18 percent of the weight of cement.
- c. Quality of Concrete (see ASTM C 94 5.1):

CLASS:	3000- 1
Size of coarse aggregate, inches	1 ½
Slump, inches	4
Entrained air, percent +/- 1 ½%	4.5
Alternate for determining proportions	3
Compressive Strength, PSI	3000
Age, days	28
Probability of tests falling below specified strength, one out of	5
Minimum content of cement plus pozzolan lbs. per c.y.	570
Admixtures – Water reducing admixtures conforming to ASTM C 494, Type A or D will be permitted at Contractor’s option.	

- d. All concrete for the work shall be Class 3000- 1 ½ unless otherwise shown on the drawings.

B. Joint Fillers

1. Joint Fillers shall comply with ASTM D 1751

C. Grout

1. Metallic: One of the following, or equal, for general applications:

“Embeco” (Master Builders Company)

- a. “Ferrolith G” (Sonneborn Building Products, Inc.)
- b. “Ferrotex” (National Pulverized Metals, Co., Chicago, IL.)

2. Non-Metallic: One of the following, or equal, for setting base plates:

- e. “Five Star Grout” (U.S. Grout Corp.)
- f. “Sealtight 588” (W.R. Meadows, Inc.)
- g. “Upcon” (The Upcon Co.)

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- D. Contractor shall provide full cut sheet, model number of product proposed for approval by the Owner and Architect prior to installation.

2.5 **CRUSHED STONE**

- A. Permeable material used for permeable base construction shall conform to the following specifications:

Gradation Sieve Size	Percent Passing Base Stone	Percent Passing Top Stone
1 ¼"	100	
1"	90	
¾"	80	
½"	50-80	100
3/8"	40-60	95
¼"		75
No. 4 mesh	20-40	62
No. 8 mesh	15-30	35
No. 16 mesh		20
No. 30 mesh	5-20	10-20
No. 100 mesh	2-10	2-10
No. 200 mesh	2-6	2-6

B. **RESTRICTIONS**

1. Fragmentation must be at 100%
2. Depending on the type of rock present in the crushed stone mix, other mechanical characteristics might be necessary for approval.

C. **BASE STONE**

1. Shall be a minimum of 6" compacted depth across the entire field area.

D. **TOP STONE**

1. Shall be a minimum of 2" compacted depth installed over the base stone materials. Top stone shall be per the specifications above to properly bridge and create a compact, solid surface for installation of synthetic turf system.

E. **MIRAFI FABRIC**

1. The subgrade shall be covered in its entirety with a Mirafi geotextile fabric meeting the following specifications.
2. The geotextile shall be woven from high-tenacity long-chain synthetic polymers composed of at least 95 percent by weight of polyolefins or polyesters. They

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shall form a stable network such that the filaments or yarns retain their dimensional stability relative to each other, including selvages.

- SUBGRADE STABILIZATION GEOTEXTILE

Property	Test Method	Units	Required Value	
Reinforcement Properties			MD ¹	CD ¹
Ultimate Tensile Strength	ASTM D 4595	kN/m (lbs/ft)	47.3 (3240)	39.4 (2700)
Tensile Strength @ 2% Strain	ASTM D 4595	kN/m (lbs/ft)	7.9 (540)	7.9 (540)
Tensile Strength @ 5% Strain	ASTM D 4595	kN/m (lbs/ft)	19.8 (1356)	19.8 (1356)
Coefficient of Interaction -Ci (sand)	ASTM D 5321	--	0.8	
Permittivity	ASTM D 4491	sec ⁻¹	0.52	
Apparent Opening Size	ASTM D 4751	mm (U.S. Sieve)	0.6 (30)	
Sewn Seam Strength ²	ASTM D 4884	kN/m (lbs/ft)	24.6 (1688)	
Survivability Index Values			MD ¹	CD ¹
Grab Tensile Strength	ASTM D 4632	N (lbs)	1780 (400)	1100 (250)
Tear Strength	ASTM D 4533	N (lbs)	800 (180)	440 (100)
Puncture Strength	ASTM D 4833	N (lbs)	800 (180)	
Burst Strength	ASTM D 3786	kPa (psi)	5506 (800)	
Ultraviolet Stability (after 500 hrs)	ASTM D 4355	%	70	

PART 3 -EXECUTION

3.1 GENERAL

- A. Excavating and grading shall be performed in conformance with the alignment, grade and cross-sections indicated on the drawings.

3.2 CONCRETE CURBING CONSTRUCTION SPECIFICS

- A. Preparation
 - 1. Clean existing concrete surfaces thoroughly before placing abutting fresh concrete.
- B. Concrete curbing for synthetic turf shall be a 6" x 12" concrete curb. Finish shall be medium broom with 1/2" radius corners.
- C. Curbing shall have appropriate control and construction joints installed.

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- D. Curbing shall have 2 No 4 bars placed inside the curbing and shall have a minimum clearance of 3” from all outside edges of curbing.

- E. Concrete Placement, Consolidation, Curing and Protection
 - 1. Concrete shall be placed, consolidated, cured and protected in accordance with American Concrete Institute recommended practice. The following ACI standards and reports are guides to good practice and shall be used by the Contractor:
 - a. ACI 304: Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
 - b. ACI 305: Hot Weather Concreting
 - c. ACI 306: Cold Weather Concreting
 - d. ACI 308: Recommended Practice for Curing Concrete
 - e. ACI 309: Recommended Practice for Consolidation of Concrete

- F. Placing Metal Reinforcement
 - 1. Place in accordance with ACI 318, Chapters 7 and 12.
 - 2. All reinforcement steel must be tied securely with 16 gauge or larger annealed iron wire, in accordance to clearance guidelines and proper location per drawing.
 - 3. Place steel with concrete cover in accordance with ACI 318, Chapter 7, Paragraph 7.7, unless otherwise indicated.
 - 4. Splice steel not less than 30-bar diameter for ASTM A615, Grade 40, and 43-bar diameter for ASTM A615, Grade 60, unless otherwise indicated. For plain bars, splice not less than twice that deformed bars.

- G. Embedded Items
 - 1. Conform to ACI 301, Chapter 6
 - 2. Accurately set anchorage devices and structural steel connections by line and transit, and coordinate the locating of all anchorage devices to be set for the accommodation of the work of other trades.
 - 3. Locate anchor belts as shown on the drawings and on shop drawings. Obtain necessary templates for mechanical and electrical equipment as required for the proper setting of anchor bolts and other items.

3.3 TURF NAILER

- A. After installation of the concrete curbing the contractor shall install the nailer, prior to final placement of the topstone rock for synthetic turf base.
- B. Nailer shall be installed using concrete anchors as specified.
- C. Nailer shall be anchored at both end of board, and every 2' along entire length of product installed.
- D. Nailer shall be installed to an approved dimension below grade, as specified by the synthetic turf carpet supplier. Contractor shall verify finish grade of nailer with turf contractor.
- E. Any anchors that do not fully drive into concrete shall be removed and new anchor installed adjacent on either side of the previous anchor that failed to install fully.

3.4 SUBSURFACE DRAINAGE

- A. All subsurface laterals shall be designed by contractor's engineer, and installed per plans.
- B. Lateral drain lines shall be 4" perforated, ADS or equal product
- C. Laterals shall be buried in a pea gravel like materials
- D. Laterals shall have a minimum of 2" of clean materials below the pipe, above subgrade materials
- E. Lateral lines shall NOT, be covered by a geotextile fabric. If geotextile is required by permitting, it shall only be on sides, and bottom of lateral line trench. Covering of top of lateral drainage trench shall not be permitted.
- F. Collector drains shall be installed per the slopes designed by the contractors' engineer. Pipes shall be installed, connected and fully mudded into any and all catch basins, or drop boxes designed.
- G. All collector pipes shall be bedded per contractor's engineer. Owner and Architect will verify proper installation.
- H. All pipes shall be installed per slopes and grades shown on contractors approved plans, shop drawings, and permitted drawings.

3.5 PERMEABLE CRUSHED ROCK BASE

- A. The base stone shall be installed in a 6" lift across the sub-grade and compacted.
- B. Top stone shall be 2" depth of topstone. Stone shall be placed in such a manner to control moisture content, and to control segregation of the fines from the stone.

- C. All stone shall be placed with fully automated equipment per section 1.08B (Quality Assurance).

3.6 GEOTEXTILE FABRIC

- A. The geotextile shall be laid smooth without wrinkles or folds on the prepared subgrade in the direction of construction traffic. Adjacent geotextile rolls shall be overlapped. Overlaps shall be in the direction as shown on the plans and in accordance with the manufacturer's requirements.

3.7 SITE PREPARATION

- A. The Contractor shall strip all debris and organic matter from areas to be graded for the synthetic turf base.
- B. All drain line spoils shall be removed from subgrade and all subgrade areas shall be rolled and compacted to 95% and compaction test results submitted to Synthetic Turf Contractor, Owner and Architect for approval and for the records.

3.8 SUBGRADE EXCAVATION AND GRADING

- A. The subgrade shall be excavated to create a positive slope towards the subsurface drainpipes. Unless otherwise specified on the drawings, the minimum slope of the subgrade shall be 1%.
- B. Following rough grading of the subgrade, the exposed soil shall be moisture conditioned to near the optimum moisture content and compacted to at least 90 percent relative compaction (modified proctor) to produce a firm non-yielding surface.
- C. No work shall be completed in this section until subgrade is 100% completed and accepted by the Architect and Owner or their representative.
- D. Subgrade after compaction and inspection shall be covered with a mirafi geotextile fabric between all drain line locations. Fabric shall be non woven, and be approved.

3.9 COMPACTED FILL

- A. Any fill material placed to create the planned subgrade shall be per Florida DOT standards for Common Burrow Specification and placed in layers eight inches or less in loose thickness, moisture conditioned to near the optimum moisture content and compacted to achieve at least 90 percent relative compaction, unless otherwise specified.
- B. Perform field density tests to determine the degree of compaction obtained. Where compaction is less than that required, additional compactive effort and/or adjustment of the moisture content shall be performed, as necessary, until the required compaction is obtained.
- C. Place and compact approved fill material in accordance with the specifications. In the case of the required density is not met, reduce the rate of haul, furnish additional

spreading and/or compaction equipment, remove and replace the fill material, or make any other adjustments necessary to achieve a satisfactorily compacted fill.

- D. No fill shall be compacted during periods of rain or on ground that is saturated or has standing water. Soil that has been over-saturated by rain or any other means shall not be used until the moisture content is within limits required by the Owner and Architect.

3.10 SUBGRADE SLOPES AND FINAL GRADES

- A. Final subgrade grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.06 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is required.
- B. All subgrade grades shown on the drawings shall be completed by the Contractor and inspected. If survey is required for finish grades all testing and special inspections shall be by Contractor.

3.11 BASE ANCHORS

- A. All baseball base anchors shall be installed into the synthetic turf base per manufacturer's instructions and specifications.
- B. Height of base anchors shall be installed per plans.
- C. Anchor installation shall be per approved shop drawings.

3.12 PERMEABLE BASE AND TOP STONE

- A. The specified base stone shall be carefully placed and compacted over the subgrade and/or drainpipe to the grades and elevations shown on the drawings. If the thickness of the planned base stone exceeds 6 inches, the stone shall be placed in horizontal layers not to exceed 6 inches and each layer proof rolled to 95 percent relative compaction (modified proctor) with a vibratory smooth drum roller. Testing shall be done using the nuclear method.
- B. Moisture Content of the stone shall be 4% - 7% of dry weight to ensure no migration of fines during transport and installation. Installation of base stone shall not be permitted during periods of heavy rainfall or moisture. Segregation of fines during transport will not be acceptable and stockpiling. Field specialty contractor is to apply water during construction to keep proper moisture content. In case of inclement weather contractor is to protect stone already on site and in place to ensure fines do not wash out of materials. This means covering all work with visquine and sandbags or other means to keep visquine in place during weather.
- C. Each layer of materials shall be uniformly spread and not move more than 10' from location of import onto site. Any rock materials that are seen to have been worked more than once with equipment shall be removed.

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- D. Base stone for the synthetic field shall be placed to a 6” compacted thickness with a finish grade with no slope on infield area as indicated on drawings.
- E. Top stone for the synthetic turf field to be 2” compacted depth. Approval of the subgrade fill materials shall be completed and tested for compaction prior to any work being done in this area.
- F. Finished surface shall be proof rolled with a vibratory smooth double drum roller to provide a non-yielding, smooth, flat surface. Compaction must be to 95%-modified proctor.
- G. Final crushed rock base grades shall conform to the lines and grades shown on the drawings. The measured grades shall not deviate more than 0.04 feet from the planned grades and not vary more than 0.04 feet in 10 feet in any direction. Laser grading is required.
- H. The top surface of the base stone shall be flat from the centerline toward the sideline as shown on the drawings.
- I. All base stone grades shown on the drawings shall be completed by the Contractor and inspected by the Architect and synthetic turf representative prior to commencing with the subsequent work items.
- J. Finished base stone must meet the minimum permeability rate acceptable to the synthetic turf manufacturer. The Contractor will do a bucket test at 6 locations as directed by the Owner, Architect and synthetic turf manufacturer. The Contractor will record the permeability rate for approval by the Architect and the synthetic turf manufacturer.

END OF SECTION

SECTION 02890
SYNTHETIC TURF SYSTEM

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Conform to the General Conditions, Supplementary Conditions, and Division 1.
- B. All Division 2 and related technical specification sections.

1.2 DESCRIPTION OF WORK

- A. Design, permitting, furnish and install Synthetic Turf System, to include all fabrication, shop drawing documents, submittals, labor, materials, lines, marking, associated items to meet the performance criteria as outlined in the construction documents. The installation of the new synthetic turf field shall conform in strict accordance to these specifications, manufacturer's instructions, and the approved design documents.
- B. The project shall consist of a baseball infield, outfield, inlaid lines, bases, mounds, and attachment to the nailer (as described in the Permeable Rock Base scope of work section), colors, and associated construction and materials to install a fully functional, and operable synthetic turf system.
- C. Baseball field markings shall include base lines, foul lines, base pegs, and pitching rubbers as shown on the schematic plan for synthetic turf.
- D. Baseball base pegs shall also be installed as directed by Owner.
- E. The synthetic turf shall be attached to the nailer that will be provided by the base work contractor.
- F. The scope of work for the synthetic turf system installer shall be as shown on the design documents to include, but not fully limited to the following items;
 - 1. Inspect and approve the new rock sub base system. Synthetic turf contractor shall coordinate with base work contractor and Owner or Owners Representative for the inspection and approval of the rock base.
 - 2. Installation of new infill synthetic turf system. This shall include, but is not limited to, all labor, materials, equipment, adhesives, and items required for the new synthetic turf system.
 - 3. Installation of baseball lines and marks in white per the schematic drawing.
 - 4. Furnish and install base pegs for all bases as outlined in part 2 of this specification.
 - 5. Furnish six copies of appropriate maintenance manual.

1.3 RELATED SECTIONS

- A. Section 02880 – Permeable Base for Synthetic Turf

1.4 RELATED DOCUMENTS

- A. Synthetic Turf Council (STC) – Minimum Standards for Synthetic Turf
- B. American Society of Testing and materials (ASTM)
- C. Consumer Product Safety Commission (CPSC)
- D. National Federation of State High School Associations (NFSHSA)

1.5 CONTRACTOR QUALIFICATIONS

- A. **Manufacturer Qualifications:** Manufacturer must have at least three years of experience in the design and manufacture of infilled turf systems with a record of successful in-service performance. Provide a list to Owner with bid.
- B. **Superintendent Qualifications:** Installer’s job foreman shall have installed a minimum of 10 fields of similar size and type using the in-filled turf systems and whose work has resulted in construction with a record of successful in-service performance. Provide resume for the Superintendent with Name, information, and list of projects as Superintendent shall be provided with the bid.
- C. **Install Crew Qualifications:** The synthetic turf surface installation crew whether subcontracted, or employed by the turf company shall have the following competent workmen skilled in the specific type of infill synthetic turf install on site daily during the complete synthetic turf install process.
 - 1. One Foreman/lead installer on site who has individually installed a minimum of 10 synthetic turf athletic turf surfaces as foreman similar in size and scope
 - 2. At any time after award of the contract and before the completion of the project, should any member of the approved crew or subcontractor discontinue their relationship with the synthetic turf crew or subcontractor the Owner shall be notified. Failure to provide installation crew personnel meeting the minimum qualifications shall be considered in default of the contract requirements.
 - 3. The designated Foreman shall be certified, in writing by the Synthetic Turf provider, as competent in the installation of this synthetic surface, including all seams, either glued or sewn, and proper installation of infill materials.
 - 4. The Synthetic Turf Provider shall have a representative on site to certify the installation and Warranty compliance.
- D. The synthetic turf surface, including yarn and carpet backing shall be supplied by a single manufacturer, supplier, or vendor. Provide additional components including anchoring materials, seaming products, binders, adhesives, resilient underlayment (where applicable) from single sources.
- E. The synthetic turf system shall be further warranted for a minimum period of 8 years to provide a “G-Max” rating of no higher than 175 per ASTM F355 & F1936, standard

Test Method for Shock-Absorbing Properties of Playing Surface Systems and Materials, Test Method A. Upon Installation the product can have no less than 80 and no more than a 130 “G-max”.

- F. Gmax testing shall be conducted at the contractor’s expense by an authorized Gmax testing firm approved by the Owner and Architect. Coordinate testing with Architect, Synthetic turf contractor, and owner.
- G. “G-max” testing shall be completed and provided by the Synthetic Turf Contractor prior to substantial completion acceptance, once every year at the annual date (which shall be the final acceptance date of the project) throughout the warranty of the product. This shall be at the expense of the synthetic turf contractor for all testing costs.
- H. Infiltration testing shall be completed upon the synthetic turf system using ASTM D3385, and also upon a laboratory sample to be completed at the time of ASTM testing, by a local testing firm authorized by the Architect and owner. Infiltration testing shall use the double ring Infiltrometer testing, in four locations on the pitch to be selected by the Architect.
- I. Infill material testing: Conformance with the infill material depth shall be completed at time of substantial completion testing. Inspection will utilize a 50’ grid across the pitch, including out of play areas, and returned to the contractor. Depth that is more than ¼” out of specification will require additional infill materials to be provided. Purchase/Delivery tickets for additional materials will be submitted to Architect, and Owner to prove additional materials has been added.

1.6 JOB CONDITIONS

- A. Synthetic Turf installation shall not occur under the following conditions
 - 1. Installation shall not occur if ambient air temperature is below 32 degrees F., materials temperatures are below 32 degrees F., rain is falling or pending and/or conditions exist, or are pending, that will be unsuitable to the installation of the synthetic turf system or any of its components.
 - 2. Excessive rainy or wet conditions have occurred so as application of adhesives will not properly cure or set as per manufacturer’s recommendations and instructions, or project specifications.

1.7 SUBMITTALS

- A. SHOP DRAWINGS: Within 21 calendar days after issuance of “Notice to Proceed”, submit to the Owner and Architect complete and detailed drawings showing all component parts of the synthetic turf system including curbing, nailier, base section, rock depths, lateral drains, collector drainage, any required storm drainage connections seam details, seam layouts, glue patterns (as applicable), lines and field markings. All drawings are to be in CAD format, and have all roles outlined and numbered with lot and roll number on the drawings. This will be the basis of selection of rolls for testing and matching products on site. Rolls that do not match will be rejected at no cost to the owner.
- B. PRODUCT DATA AND TURF SAMPLES: Within 14 calendar days after “Notice to Proceed”, submit to the Architect:

1. 6 Copies of bid products cut sheets, and testing data.
2. 6 Copies of documentation as to sources of component materials and related characteristics.
3. Roll and lot ID numbers for production for the selection of random rolls/samples for testing of the synthetic turf per the ASTM standards for the project.

C. ASTM MATERIAL TESTING RESULTS

1. Submittals from 6 random rolls, selected by the Architect from roll and lot ID submittals, of finished tufted coated synthetic turf, and one roll of tufted only product prior to coating selected from the shop drawings by the Architect will be required for testing of the ASTM properties as identified below of the synthetic turf product section. The samples will be 3' in depth and 9' in width of the 15' width of the roll. All rolls shall be produced in the proper length to allow for this to occur. Attach roll and lot numbers to each sample for matching of the roll and lot numbers in the field. Ensure remaining rolls are large enough for full install without any head seams.

D. CERTIFICATION OF THE BASE

1. Synthetic turf contractor shall be responsible for inspection, and certification of the base work. Contractor shall notify the Owner and Architect in writing of the acceptance, or rejection, of the base after inspection.

1.8 DELIVERY, STORAGE AND PROTECTION

- A. Synthetic Turf carpet shall not be authorized for delivery to the project site until all testing of the Synthetic Turf Carpet is completed, and authorized for installation. Authorization for shipment of product from manufacturer shall be in writing from Owner's Representative.
- B. Shipping of synthetic Turf product prior to written authorization shall result in all products being rejected and remanufacture and retesting of new carpet shall be at the expense of the manufacturer, and further expenses incurred by the Owner shall be paid in full by the manufacturer, to include contractor damages as outlined within the general conditions of the project.
- C. Deliver materials to the project site in original, unopened containers or wrapping from production with proper tags, and labels of product manufactured for this specific project.
- D. Provide storage for all materials in such a manner as to prevent contamination of infill materials, or exposure from heat, wind, rain, UV. Ensure infill materials are maintained in a dry condition as such to allow for proper install of project without delays. Handle all materials in accordance with manufacturer's recommendations, and requirements of the warranty.

1.9 FIELD VERIFICATION

- A. A representative of the Synthetic Turf Manufacturer shall be present intermittently to observe and inspect the base contractors work for conformance to the standards, and requirements for warranty of the synthetic turf. Such observations, testing,

SYNTHETIC TURF SYSTEM

measurements, and approvals shall be completed in writing and provided to the Base Contractor or subcontractor, Owner's Representative, and the Owner prior to installation of the synthetic turf product. Soil/Aggregate relative compaction will be determined in general accordance with the American Society for Testing and Materials (ASTM) Test Methods D1557 (modified proctor) and D2167, D2922, or D3017.

1.10 WARRANTY

- A. The manufacturer shall warrant the synthetic turf system for a minimum period of 8 years against all defects in workmanship and premature wear and tear.
- B. The synthetic turf system shall be further warranted for a minimum period of 8 years from ultraviolet degradation due to normal exposure to the sun.
- C. Contractor warrants to the Owner that its synthetic turf materials shall not fade, fail, shrink, or reflect excessive wear. Contractor shall, at their sole expense and cost, replace such areas of the synthetic turf system not performing to these standards for the life of the warranty, at no additional cost to Owner.
- D. The fabric seams shall not separate or become unglued or unattached during the 8-year warranty period.
- E. A principal of the applicable firm, duly authorized to make contracts shall sign the synthetic turf warranty. Warranty period shall be a minimum of eight years from date of final acceptance of the installed system by the Owner.

1.11 NOT USED**1.12 DEFINITIONS:**

- A. The term "not fade" in the context of this warranty shall mean that the synthetic turf material shall remain a uniform shade of green, or other colors installed, with no significant loss of color.
- B. The term "not fail" or "excessive wear" as used in the context of this warranty shall mean that the length and weight of the face yarn or pile material in the synthetic turf surface shall not have been decreased by more than 10% per year according to ASTM D418, nor exceed 50% during the warranty period. In the event that the synthetic turf system does not retain its fiber height or shock absorbency and is consequently no longer serviceable during the warranty period, the Contractor shall, at their sole expense, replace such portion of the system that is no longer serviceable, at no additional cost to Owner.
- C. The term "serviceable" in the context of this warranty shall include that the synthetic turf system shall have a maximum "G" value according to ASTM F355 & F1936, not to exceed 130G's in any location based on an average of the 2nd and 3rd drops upon installation and shall not exceed 175G's maximum during the warranty of the product.
- D. Defects, product failure and impact attenuation failure shall result in the synthetic turf being replaced by the manufacturer at no additional cost to the Owner.
- E. Lead Compliant, shall mean that the products and synthetic turf shall meet all applicable standards for the CPSC requirements of lead within the synthetic turf

system.

PART 2 – PRODUCTS

2.1 SYNTHETIC TURF SYSTEM

- A. Permeable and infilled synthetic turf which provides the look, the feel, and the playability of natural grass with respect to ball speed and bounce, and maximum safety to the athletes.
- B. The average abrasiveness index according to ASTM F1015 shall not exceed 25. This shall be determined by conducting tests at locations in accordance with ASTM F1936, Article 8.
- C. The entire system shall be resistant to weather, insects, rot, mildew, and fungus growth, and be non-allergenic and non-toxic. The entire system shall be constructed to maximize dimensional stability, to resist damage and normal wear and tear from its designated use, and to minimize ultraviolet degradation.
- D. All adhesives used in bonding the system together shall be resistant to moisture, bacterial and fungus attacks, and resistant to ultraviolet rays at any location upon installation.
- E. All proposed synthetic turf systems shall be a true monofilament system, monotype, or mono filament like systems shall be allowed. All monofilament fibers shall be polyethylene or co polymer fiber tufted into a permeable backing system, with a secondary backing.

2.2 DYNAMIC CUSHIONING REQUIREMENTS OF THE SYNTHETIC TURF SYSTEM

- A. The dynamic cushioning of the synthetic turf shall be in conformance with section 1.08 A to E of this specification, 02890, for ‘G-max’ in accordance with ASTM F355 & F1936.

2.3 PERMEABILITY REQUIREMENTS OF THE SYNTHETIC TURF SYSTEM

- A. The synthetic turf system shall be vertically draining and utilize the prepared permeable base as the primary means of collecting and diverting rainwater falling within the limits of the field. The permeability of the synthetic turf system shall be at least 15 inches/hour. This shall be determined by having tests conducted on representative infilled samples by a recognized testing laboratory. The primary carpet backing shall not have any perforations with a diameter larger than 1/2 inch.

2.4 SYNTHETIC TURF PILE SURFACE

- A. The surface shall provide superior traction in all types of weather with the use of conventional athletic shoes and composition molded-soles. Long cleats should not be required for play on this finished surface.

2.5 SYNTHETIC TURF FABRIC SURFACE

- A. The fabric surface shall be constructed and installed in minimum 15 foot widths with no longitudinal or transverse seams, except for head or tee seams at field boundaries

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and inlaid lines within a finished roll assembly. The seams shall be 15'-0" spacing with the main marking lines located and tufted into the appropriate rolls. Rolls that do not lay evenly and with full dimension width will be rejected. No fitted pieces will be allowed to straighten alignment. Turf panels that do not meet these requirements will be rejected and must be removed from the site. Produce each roll long enough to allow random sampling of a 3' depth by width of each roll for testing at the above mentioned testing Laboratory.

2.6 MINIMUM SPECIFICATIONS FOR INFILLED SYNTHETIC TURF SURFACE

- A. The minimum material will be verified and enforced and will be the basis for Owner's testing. Material that fails to meet these minimum specifications will be rejected. In-fill material must be submitted for approval by the Owner and Architect prior to installation.
- B. Yarn Pile: Shall be a polyethylene and or polypropylene combination co polymer athletic quality yarn designed specifically for outdoor use and stabilized to resist the effects of ultra-violet breakdown, heat, wear, water and airborne pollution. Fiber shall be a true mono-filament, no mono tape products allowed, tufted into a backing

<u>Item</u>	<u>Standard</u>	<u>Property</u>	<u>Minimum Specifications</u>
1.	PE	Pile Yarn Type	Thilon XTMS or Approved Equal
2.	D418	Yarn Denier	9,000 nominal
3.	D2256	Yarn Breaking Strength	>30 lbs to break
4.	D2256	Yarn Elongation	>10% to break
5.	D789	Yarn Melting Point	300° F
6.	D418/D5848	Pile Weight minimum	>35 oz/sq. yard
7.	D418/D5848	Primary Backing	>7oz/sq yard total
8.	D418/D5848	Back Coating	>18 oz/sq. yard
9.	D418/D5848	Total Weight	60 oz/sq. yard
10.	D418/D5848	Pile Height	2-1/2" nominal
11.	D1335/F1551	Tuft Bind (without infill)	STC Minimum.
12.	D5034	Grab/Tear (width)	200 lbs.
13.	D5034	Grab/Tear (length)	250 lbs
14.	D2859	Pill Burn Test	Pass
15.	Labosport Cycle Test (Roll Stud)		20,000 Cycles

- C. Synthetic turf contractor will submit the amount of materials as indicated in the submittal sections for testing to one of the listed testing agencies, as indicated in section 1.07 C.2. Synthetic turf will not be shipped to the site without prior authorization after completion of the above testing for synthetic turf surfacing. If the initial synthetic turf testing results in failure to comply remanufacture of the entire field will occur. In such case the Architect will be taken to the manufacturing facility, at the turf contractor's expense for travel, lodging, and compensated for all time to include travel to and from facility, to remove the samples and take them to the testing lab prior to shipment.
- D. Ensure Rolls are long enough for testing and installation without head seams required where not allowed.
- E. Color of the synthetic turf to be verified during the submittal process with the Owner and Architect prior to manufacture

2.7 LABOSPORT CYCLE TEST (ROLL STUD)

- A. The synthetic turf shall be tested using the Labosport Cycle Test, as described within the FIFA test methods. FIFA test 10 shall be used for the Cycle Test. Proper test methods and results for the product shall be part of the submittal process.
- B. Results and sample of materials shall be supplied to the Owners Rep if requested to ensure adherence to the synthetic turf specifications.

2.8 INFILL MATERIAL

- A. Resilient infill shall meet the minimum specifications below:

<i>Property</i>	<i>Standard</i>	<i>Specification</i>
Rubber Granule Comp		All black SBR or EPDM from on road tires.
Rubber Sieve Analysis	ASTM D 5644	#10 Sieve: 0-15% retained #12 Sieve: 0-30% retained #16 Sieve: 40-70% retained #20 Sieve: 15-35% retained #30 Sieve: 0-15% retained #40 Sieve: 0-3% retained
Fiber Content		Less 0.5%
Rubber Quantity		Per system requirements
Total Ash Content (SBR)		5%-8%
Sand Granules Shape	ASTM D442	Angular & Sub-angular no particles not acceptable
Sand Sieve Analysis	ASTM E11	#16 Sieve: 0% retained #20 Sieve: 0-20% retained #30 Sieve: 45-65% retained #40 Sieve: 20-30% retained #50 Sieve: 5-15% retained
Depth of Infill	Depth from top of infill to surface of fabric	Per system requirements
Sand hardness		7 Moh
Sand Roundness		0.6-0.7
Sand Process		Not Crushed

- B. The infill material shall be a combination of sand and rubber or all rubber, manufacturer's choice. The maximum sand content shall not exceed 30% by weight; or the infill material shall be rubber crumb.
- C. The silica sand shall have a turbidity of less than 100%
- D. If cryogenic rubber is used for infill, an additional 10mm of rubber shall be placed in the product.
- E. Infill depth shall be 2" at time of install, and field shall be top-dressed by Synthetic turf contractor one year later with proper quantity of infill mix to achieve 2" compacted depth @ one year warranty Gmax testing.

2.9 ACCESSORIES

- A. Provide all necessary materials, equipment and accessories for a complete installation as recommended by the manufacturer. This includes all glue, adhesives, backings, extra turf materials for markings and inlays, scrim materials, tools, labor, equipment, and site protection of adjacent amenities.

PART 3 - EXECUTION

3.1 CERTIFICATION OF BASE

- A. The Contractor is responsible for inspecting, verifying, and accepting the final grade of the base.
- B. Synthetic turf contractor shall coordinate with the base work contractor, the Architect and the Owner for final walk-through inspection. It is highly recommended that the synthetic turf contractor coordinate with the base contractor prior to final acceptance walk-through.

3.2 INSTALLATION

- A. Perform all work in strict accordance to the drawings, shop drawings and manufacturer's specifications and instructions.
 - 1. Verification: The Contractor is responsible for inspecting, verifying, and accepting all installed work of this section.
 - 2. Environmental Conditions: Do not apply adhesive materials or infill material when ambient air temperature is below 32 degrees F., material temperatures are below 32 degrees F., rain is falling or pending and/or conditions exist, or are pending, that will be unsuitable to the installation of the system.
 - 3. Immediately prior to application of the synthetic turf, the base shall be thoroughly cleaned of all foreign material, soil, or any other substances that may be detrimental to permeability and the installation of the turf system.

3.3 INSPECTION OF MATERIALS

- A. Prior to installation, and immediately upon delivery of synthetic turf system materials to the project site, the Synthetic Turf Surfacing Contractor, Architect and the Owner shall inspect material as follows:
 - 1. Damaged or defective items
 - 2. Measure turf pile height and thickness of each roll
 - 3. Inspect alignment of turf panel sides.
 - 4. Reject damaged materials and all materials out of tolerance with this specification.
 - 5. Verify Roll and Lot numbers against submittal information. Verify all rolls with materials removed for testing have been shipped to site.

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- B. After installation, inspect project area for acceptable seaming, adhesive bonding, for uniformity of color of turf, bubble-free surface smoothness as laid, surface depressions, filed lines and markings, insert installations, edge details. Remove and/or repair deficient workmanship prior to requesting the Owner and Architect's inspection pursuant to completion and acceptance of the work.

3.4 OWNER'S TEST

- A. The Owner may request for samples of the turf to be tested for verification of conformance to specifications. Turf system acceptance is subject to the results of these tests.
- B. Any material tested and found not conforming to specification will be rejected and replaced with material conforming to the specification at Synthetic Turf Surfacing Contractor's expense. Re-submittal will be required.

3.5 TURF INSTALLATION

- A. Turf shall be attached to the nailer as installed for the entire outside perimeter and for all baseball clay cut out areas. Use of 1 ½" minimum galvanized staples on all nailer locations.
- B. Turf shall be installed over the slabs at cutout areas, and rolled down the nailer and installed on the side of the nailers prior to backfill with clay infield section materials.
- C. Bonding of Material Surfaces: The bonding or fastening of all system material components shall provide a permanent, tight, secure and hazard-free, athletic playing surface. System material components include:
 - 1. Bonding all seams and inlaid line and markings.
 - 2. Bonding and seaming must maintain their integrity for total length or warranty period.
- D. Seams (Joint):
 - 1. All seams for panels and inlaid markings shall have open mesh or be perforated from the top after installation backing with adhesive bonding.
 - 2. Seams for all main turf panels are to be sewn or glued with approved adhesive.
 - 3. All seams shall be brushed to provide full coverage of fiber over the seam.

3.6 CLEANING

- A. Remove all excess materials of all types, equipment, debris, etc., from the site immediately after completion of the work. Remove all stains and other blemishes from all finished surfaces. Leave work in clean, new appearing condition, ready for use by Owner.

3.7 PROTECTION

- A. Adequate protection of materials and work from damage will be the responsibility of the installer during installation and until acceptance of their work. Synthetic Turf

Surfacing Contractor will be responsible for protection after the acceptance of the work until final acceptance of all contract work by the Owner.

- B. Special precaution is to be made to protect turf when track structural sprays are being applied.
- C. All material damaged prior to acceptance by the Owner shall be replaced at no cost to the Owner.

3.8 EQUIPMENT

- A. Provide all specified equipment to the Owner prior to substantial completion of the project. Include equipment, owner's manual, and warranty information.

3.9 DEMONSTRATION AND OWNER TRAINING SESSION

- A. Contractor shall provide Owner with a maintenance manual and operations manual prior to substantial completion of the project.
- B. Contractor shall train all Owner staff, as the Owner deems necessary, and provide a schedule for this training. Training shall include all items applicable to the warranty of the product, manufacturers recommended practices of daily, weekly, monthly, quarterly and annual care to the facility.
- C. Contractor shall include sample infill additions, gum removal, seed removal, and normal trash/sweeper equipment operation. Grooming operation, directions and frequency of such activities.
- D. Contractor shall provide to the Owner in written format a sample of a typical maintenance log to be kept by the city for maintenance of the synthetic turf system.
- E. All testing and training shall be completed by the contractor with the Owner prior to substantial completion of the project.

END SECTION

SECTION 05500 - METAL FABRICATIONS**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.

1.2 SUMMARY

- A. This Section includes the following:

1. Steel Ladders
2. Loose steel lintels.
3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
4. Miscellaneous metal trim.

1.3 SUBMITTALS

- A. Shop Drawings: Detail fabrication and erection of each metal fabrication indicated. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm experienced in producing metal fabrications similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Welding: Qualify procedures and personnel according to the following:
 1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.2, "Structural Welding Code--Aluminum."
 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 4. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

- A. Metal Surfaces, General: For metal fabrications exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Steel Tubing: Cold-formed steel tubing complying with ASTM A 500.
- G. Steel Pipe: ASTM A 53, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- H. Malleable-Iron Castings: **ASTM A 47, Grade 32510**.
- I. Gray-Iron Castings: **ASTM A 48, Class 30**, unless another class is indicated or required by structural loads.

2.3 PAINT

- A. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. Bituminous Paint: Cold-applied asphalt mastic complying with SSPC-Paint 12, except containing no asbestos fibers, or cold-applied asphalt emulsion complying with ASTM D 1187.

2.4 FASTENERS

- A. General: Provide Type 304 or 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Bolts and Nuts: Regular hexagon-head bolts, **ASTM A 307, Grade A**; with hex nuts, **ASTM A 563**; and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F 1554, Grade 36.
- D. Machine Screws: **ASME B18.6.3**.
- E. Lag Bolts: **ASME B18.2.1**.
- F. Wood Screws: Flat head, carbon steel, ASME B18.6.1.
- G. Plain Washers: Round, carbon steel, **ASME B18.22.1**.
- H. Lock Washers: Helical, spring type, carbon steel, **ASME B18.21.1**.
- I. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

1. Material: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Alloy Group 1 or 2 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

J. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as needed.

2.5 GROUT

- A. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.6 CONCRETE FILL

- A. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.

2.7 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Shear and punch metals cleanly and accurately. Remove burrs.
- C. Ease exposed edges to a radius of approximately 1/32 inch, unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Weld corners and seams continuously to comply 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- E. Provide for anchorage of type indicated; coordinate with supporting structure. Fabricate and space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- F. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- G. Fabricate joints that will be exposed to weather in a manner to exclude water, or provide weep holes where water may accumulate.
- H. Allow for thermal movement resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening up of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

- I. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
- J. Remove sharp or rough areas on exposed traffic surfaces.
- K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flat-head (countersunk) screws or bolts. Locate joints where least conspicuous.

2.8 LADDER

- A. General: Fabricate ladders for locations shown, with dimensions, spacings, details, and anchorages as indicated.
 - 1. Comply with ANSI A14.3, unless otherwise indicated.
- B. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches apart.
- C. Bar Rungs: 1/2 inch x 2 1/2 inch - steel bars, spaced 12 inches o.c.
- D. Fit rungs in centerline of side rails; plug-weld and grind smooth on outer rail faces.
- E. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.
 - 1. Provide nonslip surfaces on top of each.

2.9 LOOSE STEEL LINTELS

- A. Fabricate loose structural-steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Weld adjoining members together to form a single unit where indicated.
- C. Size loose lintels to provide bearing length at each side of openings equal to one-twelfth of clear span, but not less than 8 inches, unless otherwise indicated.

2.10 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports that are not a part of structural-steel framework as necessary to complete the Work.
- B. General: Provide steel framing and supports indicated and as necessary to complete the Work.
- C. Fabricate units from structural-steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

2.11 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from structural-steel shapes, plates, and bars of profiles shown with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work. Provide anchors, welded to trim, for embedding in concrete or masonry construction, spaced not more than **6 inches** from each end, **6 inches** from corners, and **24 inches** o.c., unless otherwise indicated.

2.12 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 - 1. ASTM A 123, for galvanizing steel and iron products.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed metal fabrications:
 - 1. Exteriors (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal fabrications to in-place construction. Include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- E. Field Welding: Comply with the following requirements:
 - 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. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.2 SETTING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
1. Use nonshrink grout, either metallic or nonmetallic, in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.3 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings, if any.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.
- C. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- D. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 9 Section "Painting."
- E. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05500

SECTION 06200 – FINISH CARPENTRY**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Specifications, Drawings and General Provisions of Contract to Construct Buildings : RUS Form 257 are part of this Project and the Contractor shall consult them in detail for instruction pertaining to this Work.

1.2 QUALITY ASSURANCE

- A. Perform the Work in accordance with AWI Custom Quality.

PART 2 - PART 2 - PRODUCTS

2.1 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWA C2 (lumber) and AWWA C9 (plywood).

2.2 EXTERIOR STANDING AND RUNNING TRIM, SIDING, & SOFFITS

- A. Lumber Trim for Semitransparent-Stained and Painted Applications: Kiln-dried lumber with saw-textured face and of Grade A western red cedar; NLGA, WCLIB, or WWPA.

2.3 MISCELLANEOUS MATERIALS

- A. Exterior nails or screws: Hot-dip galvanized steel. Use concealed fasteners where possible.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use overlay trim to conceal larger gaps.
- C. Install trim with nails at 8 inches on center, maximum.
- D. Install trim with minimum of joints, cope at returns. Miter at corners. Scarf end-to-end joints.
- E. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation.

- F. Use fine finishing nails for exposed nailing, countersunk and filled flush with finished surface and matching final finish where transparent is indicated except where prefinished matching fasteners heads are indicated.
- G. Install siding to comply with manufacturer's warranty requirements.

END OF SECTION 06200

SECTION 06402 - INTERIOR ARCHITECTURAL WOODWORK**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.

1.2 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, including cabinet hardware and accessories and handrail brackets.
- B. Product Data: For high-pressure decorative laminate, cabinet hardware and accessories and handrail brackets.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- D. Samples for Initial Selection : Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated:
 - 1. Shop-applied transparent finishes
 - 2. High pressure plastic laminates

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm experienced in producing architectural woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Products: Comply with the following:
 - 1. Hardboard: AHA A135.4.
 - 2. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
 - 3. Softwood Plywood: DOC PS 1, Medium Density Overlay.
 - 4. Hardwood Plywood and Face Veneers: HPVA HP-1.
- C. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
 - a. Formica Corporation.
 - b. Laminart.
 - c. Wilsonart International; Div. of Premark International, Inc.
- D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.

2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Concealed Hinges (European Type): BHMA A156.9, B01602, 100 degrees of opening, self-closing.
- D. Wire Pulls
- E. Adjustable Shelf Standards and Supports: BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: BHMA A156.9, B04013.
- G. Door Locks: BHMA A156.11, E07121.

- H. Drawer Locks: BHMA A156.11, E07041.
- I. Grommets for Cable Passage through Countertops: 2-inch OD, black, molded-plastic grommets and matching plastic caps with slot for wire passage.
 - 1. Product: Subject to compliance with requirements, by Doug Mockett and Co., Inc.
- J. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
- B. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.
- C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

2.4 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide Custom grade interior woodwork complying with the referenced quality standard.
- B. AWI type: flush overlay.
- C. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
 - 1. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
 - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.
 - 3. Corners of Cabinets and Edges of Solid-Wood (Lumber) Members and Rails: 1/16 inch.
- E. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- F. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items.

2.5 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.
- B. High-Pressure Decorative Laminate Grade: HGP.
- C. Core Material: Medium-density fiberboard made with exterior glue.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- E. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than 16 inches o.c. with No. 10 wafer-head screws sized for 1-inch penetration into wood framing, blocking, or hanging strips.
- F. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
 - 1. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Secure backsplashes to tops with concealed metal brackets at 16 inches o.c. and to walls with adhesive.
 - 3. Caulk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06402

SECTION 07130 - SELF-ADHERING SHEET WATERPROOFING

PART 1 - GENERAL

1.1 PERFORMANCE REQUIREMENTS

- A. Provide waterproofing that prevents the passage of water.

1.2 SUBMITTALS

- A. Product Data: Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

1.3 WARRANTY

- A. Special Manufacturer's Warranty: Written warranty, signed by waterproofing manufacturer agreeing to replace waterproofing material that does not comply with requirements or that does not remain watertight during specified warranty period.

PART 2 - PRODUCTS

2.1 RUBBERIZED-ASPHALT SHEET WATERPROOFING

- a. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.; CCW 701.
- b. W. R. Grace & Co.; Bituthene.
- c. Tremco; Thermastic 150.

2.2 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended by waterproofing manufacturer for intended use and compatible with sheet waterproofing.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance.

3.2 INSTALLATION

- A. Install in strict accordance with manufacturer's written instructions and standard details.

END OF SECTION 07130

SECTION 07210 - INSULATION**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.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of building insulation through one source.
- B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
 - 1. Surface-Burning Characteristics: ASTM E 84.
 - 2. Fire-Resistance Ratings: ASTM E 119.
 - 3. Combustion Characteristics: ASTM E 136.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

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:
 - 1. Glass-Fiber Insulation:
 - a. CertainTeed Corporation.
 - b. Johns Manville Corporation.
 - c. Knauf Fiber Glass.
 - d. Owens Corning.

2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.

1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
 - B. Roof: Owens Corning "Optiliner" banded liner system flush to bottom full cavity between purlins R-30, color white.
 - C. Exterior 6" Wall: "Optiliner" banded liner system flush to bottom full cavity between studs R-19, color white.
 - D. Interior 6" OR GREATER Wall, Sound Attenuation: 6" nonfaced acoustical batt insulation unless noted otherwise on plans.
 - E. Interior 3-1/2"/ 3-5/8" Wall, Sound Attenuation: 3 1/2" nonfaced acoustical batt insulation unless noted otherwise on plans.
- 2.3 VAPOR RETARDERS (building wrap)
- A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.
 - B. Foil-Polyester Film Vapor Retarder: 2 layers of 0.5-mil thick polyester film laminated to an inner layer of 1-mil thick aluminum foil, with maximum water-vapor transmission rate in flat condition of 0.0gh x sq. m and with maximum flame-spread and smoke –developed indices of 5.
 - C. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- 2.4 Energy Sealant Package (canned foam)
- A. Provide foam sealant all exterior wall and roof penetrations.
- 2.5 Foam Baffle 48" - for airflow from vented soffits to metal roof ridge vent.
- 2.6 Thermal Block – R-5 Insulation Value – for use between purlins and metal roofing. Thermal block to extend 1" past either side of purlin. General Contractor to coordinate between Pre-Engineered Metal Building Manufacturer and insulation provider.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Water-Piping Coordination: If water piping is located on inside of insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.
- E. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.
- B. Install mineral-fiber blankets in cavities formed by framing members according to the following requirements:
 - 1. Use blanket widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
 - 2. Place blankets in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
- C. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

3.5 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16 inches o.c.
- C. Firmly attach vapor retarders to substrates with mechanical fasteners or adhesives as recommended by vapor-retarder manufacturer.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.6 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

SECTION 07620 - SHEET METAL FLASHING AND TRIM**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.

1.2 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing.

1.3 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data including manufacturer's material and finish data, installation instructions, and general recommendations for each specified flashing material and fabricated product.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experience Installer who has completed sheet metal flashing and trim work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1.5 PROJECT CONDITIONS

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation. Ensure best possible weather resistance, durability of Work, and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 METALS

- A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated and with not less than the strength and durability of alloy and temper designated below:
 - 1. Extruded Aluminum: **ASTM B 221**, alloy 6063-T52, with a minimum thickness of **0.080 inch** for primary legs of extrusions that are anodized, unless otherwise indicated.

2.2 MISCELLANEOUS MATERIALS AND ACCESSORIES

- A. Fasteners: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer. Match finish of exposed heads with material being fastened.
- B. Asphalt Mastic: SSPC-Paint 12, solvent-type asphalt mastic, nominally free of sulfur and containing no asbestos fibers, compounded for **15-mil** dry film thickness per coat.

- C. Mastic Sealant: Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.
- D. Elastomeric Sealant: Generic type recommended by sheet metal manufacturer and fabricator of components being sealed and complying with requirements for joint sealants as specified in Division 7 Section "Joint Sealants."
- E. Epoxy Seam Sealer: 2-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior and interior nonmoving joints, including riveted joints.
- F. Adhesives: Type recommended by flashing sheet metal manufacturer for waterproof and weather-resistant seaming and adhesive application of flashing sheet metal.
- G. Paper Slip Sheet: **5-lb/square** red rosin, sized building paper conforming to FS UU-B-790, Type I, Style 1b.
- H. Polyethylene Underlayment: ASTM D 4397, minimum **6-mil-** thick black polyethylene film, resistant to decay when tested according to ASTM E 154.
- I. Metal Accessories: Provide sheet metal clips, straps, anchoring devices, and similar accessory units as required for installation of Work, matching or compatible with material being installed; noncorrosive; size and thickness required for performance.
- J. Gutter Screen: **1/4-inch** hardware cloth installed in sheet metal frames. Fabricate screen and frame of same basic material as gutters and downspouts.
- K. Roofing Cement: ASTM D 4586, Type I, asbestos free, asphalt based.

2.3 FABRICATION, GENERAL

- A. Sheet Metal Fabrication Standard: Fabricate sheet metal flashing and trim to comply with recommendations of SMACNA's "Architectural Sheet Metal Manual" that apply to the design, dimensions, metal, and other characteristics of the item indicated.
- B. Comply with details shown to fabricate sheet metal flashing and trim that fit substrates and result in waterproof and weather-resistant performance once installed. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Form exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems.
- D. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- E. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- F. Expansion Provisions: Space movement joints at maximum of **10 feet** with no joints allowed within **24 inches** of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch** deep, filled with mastic sealant (concealed within joints).
- G. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
- H. Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces at locations of contact with asphalt mastic or other permanent separation as recommended by manufacturer.

- I. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of sheet metal exposed to public view.
- J. Fabricate cleats and attachment devices from same material as sheet metal component being anchored or from compatible, noncorrosive metal recommended by sheet metal manufacturer.
 - 1. Size: As recommended by SMACNA manual or sheet metal manufacturer for application but never less than thickness of metal being secured.

2.4 SHEET METAL FABRICATIONS

- A. General: Fabricate sheet metal items in thickness or weight needed to comply with performance requirements but not less than that listed below for each application and metal.
- B. Gutters with Girth up to **15 Inches**: Fabricate from: Aluminum: **0.0320 inch** thick.
- C. Downspouts: Fabricate from: Aluminum: **0.024 inch** thick.
- D. Exposed Trim, Gravel Stops, and Fasciae: Fabricate from: Galvanized Steel: .0276 inch thick.
- E. Base Flashing: Fabricate from: Galvanized Steel: .0276 inch thick.
- F. Counterflashing: Fabricate from: Galvanized Steel: .0217 inch thick
- G. Flashing Receivers: Fabricate from: Galvanized Steel: .0217 inch thick
- H. Drip Edges: Fabricate from: Galvanized Steel: .0217 inch thick
- I. Eave Flashing: Fabricate from: Galvanized Steel: .0217 inch thick
- J. Equipment Support Flashing: Fabricate from: Galvanized Steel: .0276 inch thick
- K. Roof-Penetration Flashing: Fabricate from: Galvanized Steel: .0276 inch thick
- L. Overhead-Piping Safety Pans: Fabricate from: Galvanized Steel: .0396 inch thick

2.5 ALUMINUM EXTRUSION FABRICATIONS

- A. Aluminum Extrusion Units: Fabricate extruded-aluminum running units with formed or extruded-aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

2.6 ALUMINUM FINISHES

- A. General: Comply with Aluminum Association's (AA) "Designation System for Aluminum Finishes" for finish designations and application recommendations.
- B. Finish shall be mill-finish.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that Work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Unless otherwise indicated, install sheet metal flashing and trim to comply with performance requirements, manufacturer's installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated. Install Work with laps, joints, and seams that will be permanently watertight and weatherproof.
- B. Install exposed sheet metal Work that is without excessive oil canning, buckling, and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof and weather-resistant performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.
- C. Expansion Provisions: Provide for thermal expansion of exposed sheet metal Work. Space movement joints at maximum of **10 feet** with no joints allowed within **24 inches** of corner or intersection. Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently weatherproof and waterproof, form expansion joints of intermeshing hooked flanges, not less than **1 inch** deep, filled with mastic sealant (concealed within joints).
- D. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate elastomeric sealant to comply with SMACNA standards. Fill joint with sealant and form metal to completely conceal sealant.
 - 1. Use joint adhesive for nonmoving joints specified not to be soldered.
- E. Seams: Fabricate nonmoving seams in sheet metal with flat-lock seams. Tin edges to be seamed, form seams, and solder.
- F. Seams: Fabricate nonmoving seams in aluminum with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
- G. Separations: Separate metal from noncompatible metal or corrosive substrates by coating concealed surfaces, at locations of contact, with asphalt mastic or other permanent separation as recommended by manufacturer.
 - 1. Underlayment: Where installing stainless steel or aluminum directly on cementitious or wood substrates, install a slip sheet of red-rosin paper and a course of polyethylene underlayment.
 - 2. Bed flanges of Work in a thick coat of roofing cement where required for waterproof performance.
- H. Counterflashings: Coordinate installation of counterflashings with installation of assemblies to be protected by counterflashing. Install counterflashings in reglets or receivers. Secure in a waterproof manner by means of snap-in installation and sealant, lead wedges and sealant, interlocking folded seam, or blind rivets and sealant. Lap counterflashing joints a minimum of **2 inches** and bed with sealant.
- I. Roof-Drainage System: Install drainage items fabricated from sheet metal, with straps, adhesives, and anchors recommended by SMACNA's Manual or the item manufacturer, to drain roof in the most efficient manner. Coordinate roof-drain flashing installation with roof-drainage system installation. Coordinate flashing and sheet metal items for steep-sloped roofs with roofing installation.
- J. Roof-Penetration Flashing: Coordinate roof-penetration flashing installation with roofing and installation of items penetrating roof. Install flashing as follows:
 - 1. Seal and clamp flashing to pipes penetrating roof, other than lead flashing on vent piping.

- K. Install continuous gutter screens on gutters with noncorrosive fasteners, arranged as hinged units to swing open for cleaning gutters.

3.3 CLEANING AND PROTECTION

- A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.
- B. Provide final protection and maintain conditions that ensure sheet metal flashing and trim Work during construction is without damage or deterioration other than natural weathering at the time of Substantial Completion.

END OF SECTION 07620

SECTION 07920 - JOINT SEALANTS**PART 1 - GENERAL****1.1 PERFORMANCE REQUIREMENTS**

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

1.2 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.
- D. SWRI Validation Certificate: For each elastomeric sealant specified to be validated by SWRI's Sealant Validation Program.
- E. Warranties: Special warranties specified in this Section.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
 - 2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
 - 3. Test elastomeric joint sealants according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in peel, and indentation hardness.
 - 4. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F.
 - 3. When joint substrates are wet.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.6 WARRANTY

- A. Installer's standard warranty in which installer agrees to repair or replace those that do not comply with performance and other requirements specified in this section
 - 1. Warranty period: 2 years

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the

end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

2.4 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
 - 1. Type C: Closed-cell material with a surface skin.
 - 2. Type O: Open-cell material.
 - 3. Type B: Bicellular material with a surface skin.
 - 4. Type: Any material indicated above as recommended by sealant manufacturer.

2.5 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable

of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

- a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
 4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
 - a. Metal.
 - b. Glass.
 - c. Cast Iron.
 - d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of sealant backings.
 2. Do not stretch, twist, puncture, or tear sealant backings.
 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- E. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses provided for each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.
 4. Provide flush joint configuration, per Figure 5B in ASTM C 1193, where indicated.
 5. Provide recessed joint configuration, per Figure 5C in ASTM C 1193, of recess depth and at locations indicated.
 - a. Use masking tape to protect adjacent surfaces of recessed tooled joints.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Single-Component Urethane Sealant: Provide products complying with the following:
1. Products: Provide one of the following:
 - a. Sonolastic NP-1; Sonneborn, Inc.
 - b. Trem Pro 637; Tremco
 2. Type and Grade: S (single component) and NS (nonsag).
 3. Class: 25.
 4. Use Related to Exposure: NT (nontraffic).
 5. Uses Related to Joint Substrates: mortar, glass, and aluminum, and, as applicable to joint substrates indicated, other.
 - a. Use other Joint Substrates: Galvanized steel, limestone, marble, ceramic tile, and wood.
 6. Applications: As indicated on Construction Documents

3.7 ACOUSTICAL JOINT-SEALANT SCHEDULE

- A. Acoustical Sealant for Exposed and Concealed Joints: Provide products complying with the following:

1. Products: Provide one of the following:
 - a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corporation.
 - b. SHEETROCK Acoustical Sealant; USG Corp., United States Gypsum Co.
2. Applications: Head and sill of drywall partitions where sound insulation is indicated

END OF SECTION 07920

SECTION 08110 - STEEL DOORS AND FRAMES**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.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Steel doors.
 - 2. Steel door frames.
 - 3. Louvers in doors.

1.3 SUBMITTALS

- A. Product Data: For each type of door and frame indicated, include door designation, type, level and model, material description, core description, construction details, label compliance, sound and fire-resistance ratings, and finishes.
- B. Shop Drawings: Show the following:
 - 1. Elevations of each door design.
 - 2. Details of doors including vertical and horizontal edge details.
 - 3. Frame details for each frame type including dimensioned profiles.
 - 4. Details and locations of reinforcement and preparations for hardware.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, accessories, joints, and connections.
 - 7. Coordination of glazing frames and stops with glass and glazing requirements.
- C. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.4 QUALITY ASSURANCE

- A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.
- B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- C. Fire-Rated Window Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished doors and frames.
- B. Inspect doors and frames on delivery for damage, and notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- C. Store doors and frames at building site under cover. Place units on minimum 4-inch- high wood blocking. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber. If door packaging becomes wet, remove cartons immediately. Provide minimum 1/4-inch spaces between stacked doors to permit air circulation.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Manufacture door and door frames in accordance with ANSI/SDI 100 Standard Steel Doors and Frames and NFPA 80 Fire Doors and Windows where required.
- B. Fabricate and install in accordance with DHI The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

2.2 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. Steel Doors and Frames:
 - 1. Ceco Door, Milan; TX.
 - 2. Deansteel Manufacturing Company; San Antonio, TX.
 - 3. Kewanee Corporation (The); Kewanee, IL.
 - 4. Windsor Republic Doors; Mckenzie, TN.
 - 5. Steelcraft;a division of Ingersroll-Rand; Cincinnati, OH.

2.3 DOORS AND FRAMES

- A. General: Provide doors of sizes, thicknesses and designs indicated.
- B. Exterior doors: SDI 100, extra Heavy Duty, grade III, Model 2, minimum 16 ga. Faces.
- C. Interior doors: SDI 100, Heavy Duty, model 1, minimum 16 ga. Faces
- D. Core: Cardboard honeycomb or as required for fire rating.
- E. Door Louvers: Provide louvers for interior doors, where indicated that comply with SDI 111C, with blades or baffles formed of 0.020-inch-thick, cold-rolled steel set into 0.032-inch-thick steel frame.

1. Sightproof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.

2.4 FRAMES

- A. General: Provide steel frames for doors, transoms, sidelights, borrowed lights, and other openings that comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Frames: 16 ga. Welded unit type
- C. Door Silencers: Except on weather-stripped frames, fabricate stops to receive three resilient rubber silencers on strike jambs of single-door frames and two silencers on heads of double-door frames.
- D. Plaster Guards: Provide 0.016-inch- thick, steel sheet plaster guards or mortar boxes to close off interior of openings; place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.
- E. Supports and Anchors: Fabricated from not less than 0.042-inch- thick, electrolytic zinc-coated or metallic-coated steel sheet.
 1. Wall Anchors in Masonry Construction: 0.177-inch- diameter, steel wire complying with ASTM A 510 may be used in place of steel sheet.
- F. Inserts, Bolts, and Fasteners: Manufacturer's standard units. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153/A 153M, Class C or D as applicable.

2.5 FABRICATION

- A. General: Fabricate steel door and frame to be rigid, neat in appearance, and free from defects including warp and buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site.
- B. Exterior Door Construction: For exterior locations and elsewhere as indicated, fabricate doors, panels, and frames from metallic-coated steel sheet. Close top and bottom edges of doors flush as an integral part of door construction or by addition of 16 ga., metallic-coated steel channels with channel webs placed even with top and bottom edges.
- C. Interior Door Faces: Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units, from cold-rolled steel sheet.
- D. Resin-impregnated kraft/paper honeycomb.
- E. Clearances for Non-Fire-Rated Doors: Not more than 1/8 inch at jambs and heads, except not more than 1/4 inch between pairs of doors. Not more than 3/4 inch at bottom.
- F. Clearances for Fire-Rated Doors: As required by NFPA 80.
- G. Exposed Fasteners: Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.
- H. Hardware Preparation: Prepare doors and frames to receive mortised and concealed hardware. Comply with applicable requirements in ANSI A250.6 and ANSI A115 Series specifications for door and frame preparation for hardware.

- I. Frame Construction: Fabricate frames to shape shown.
 - 1. For exterior applications, fabricate frames with mitered or coped and continuously welded corners and seamless face joints.
 - 2. For interior applications, fabricate knock-down frames with mitered or coped corners, for field assembly.
 - 3. Provide welded frames with temporary spreader bars.
- J. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.
- K. Locate hardware as specified in Division 8 section "Door Hardware."
- L. Glazing Stops: Manufacturer's standard, formed from 0.032-inch- thick steel sheet.
 - 1. Provide screw-applied, removable, glazing stops on inside of glass, louvers, and other panels in doors.

2.6 FINISHES

- A. Prime Finish: Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install steel doors, frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.
- B. Placing Frames: Comply with provisions in SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
 - 1. Except for frames located in existing walls or partitions, place frames before construction of enclosing walls and ceilings.
 - 2. In masonry construction, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
 - 3. In metal-stud partitions, provide at least three wall anchors per jamb; install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Attach wall anchors to studs with screws.
 - 4. Install fire-rated frames according to NFPA 80.
 - 5. For openings 90 inches or more in height, install an additional anchor at hinge and strike jambs.
- C. Door Installation: Comply with ANSI A250.8. Fit hollow-metal doors accurately in frames, within clearances specified in ANSI A250.8. Shim as necessary to comply with SDI 122 and ANSI/DHI A115.1G.
 - 1. Fire-Rated Doors: Install within clearances specified in NFPA 80.

3.2 ADJUSTING AND CLEANING

- A. Prime-Coat Touchup: Immediately after installation, sand smooth any rusted or damaged areas of prime coat and apply touch up of compatible air-drying primer.

- B. Protection Removal: Immediately before final inspection, remove protective wrappings from doors and frames.

END OF SECTION 08110

SECTION 08410 - ALUMINUM ENTRANCES AND STOREFRONTS**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.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Exterior entrance systems.
 - 2. Exterior storefront systems.

1.3 SYSTEM DESCRIPTION

- A. General: Provide aluminum entrance and storefront systems capable of withstanding loads and thermal and structural movement requirements indicated without failure, based on testing manufacturer's standard units in assemblies similar to those indicated for this Project. Failure includes the following:
 - 1. Air infiltration and water penetration exceeding specified limits.
 - 2. Framing members transferring stresses, including those caused by thermal and structural movement, to glazing units.
- B. Glazing-to-Glazing Joints: Provide glazing-to-glazing joints that accommodate thermal and mechanical movements of glazing and system, prevent glazing-to-glazing contact, and maintain required edge clearances.
- C. Wind Loads: Provide entrance and storefront systems, including anchorage, capable of withstanding wind-load design pressures calculated according to requirements of authorities having jurisdiction or the American Society of Civil Engineers' ASCE 7, "Minimum Design Loads for Buildings and Other Structures," 6.4.2, "Analytical Procedure," whichever are more stringent.
 - 1. Deflection of framing members in a direction normal to wall plane is limited to 1/175 of clear span or **3/4 inch**, whichever is smaller, unless otherwise indicated.
- D. Air Infiltration: Provide entrance and storefront systems with permanent resistance to air leakage through fixed glazing and frame areas of not more than **0.06 cfm/sq. ft.** of fixed wall area when tested according to ASTM E 283 at a static-air-pressure difference of **1.57 lbf/sq. ft.**
- E. Water Penetration: Provide entrance and storefront systems that do not evidence water leakage through fixed glazing and frame areas when tested according to ASTM E 331 at minimum differential pressure of 20 percent of inward-acting wind-load design pressure as defined by ASCE 7, "Minimum Design Loads for Buildings and Other Structures," but not less than **6.24 lbf/sq. ft.** Water leakage is defined as follows:

1.4 SUBMITTALS

- A. Product Data: For each product specified. Include details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Shop Drawings: For entrance and storefront systems. Show details of fabrication and installation, including plans, elevations, sections, details of components, provisions for expansion and contraction, and attachments to other work.
 - 1. For entrance systems, include hardware schedule and indicate operating hardware types, quantities, and locations.
- C. Samples for Verification: Of each type of exposed finish required in manufacturer's standard sizes. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform work of this Section who has specialized in installing entrance and storefront systems similar to those required for this Project and who is acceptable to manufacturer.
- B. Source Limitations: Obtain each type of entrance and storefront system through one source from a single manufacturer.
- C. Welding Standards: Comply with applicable provisions of AWS D1.2, "Structural Welding Code--Aluminum."

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 WARRANTY

- A. The special warranty specified in this Article shall run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Oldcastle Building Envelope
 - 2. EFCO Corporation.
 - 3. YKK Inc.
 - 4. Kawneer Company, Inc.

2.2 MATERIALS

- A. Acceptable Exterior Storefront Framing System: OR EQUAL
Oldcastle Series 3000 Thermal MultiPlane, glass set to the center, thermally broken, exterior, loaded 2" x 4-1/2" mullion profile. This system uses a poured-in-place polyurethane thermal pocket to create its thermal break. This system accommodates 1" glass thickness.
- B. Acceptable Interior Storefront Framing System: OR EQUAL
Oldcastle Flush Glazed System. Center set, exterior loaded Series 2000- 1-3/4" x 4-1/2" mullion profile; accommodates 1/4" glazing only.
- C. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with the requirements of standards indicated below.
 - 1. Sheet and Plate: **ASTM B 209**.
 - 2. Extruded Bars, Rods, Shapes, and Tubes: **ASTM B 221**.
 - 3. Extruded Structural Pipe and Tubes: **ASTM B 429**.
 - 4. Bars, Rods, and Wire: **ASTM B 211**.
 - 5. Welding Rods and Bare Electrodes: **AWS A5.10**.
- D. Steel Reinforcement: Complying with **ASTM A 36** for structural shapes, plates, and bars; **ASTM A 611** for cold-rolled sheet and strip; or **ASTM A 570** for hot-rolled sheet and strip.
- E. Glazing as specified in Division 8 Section "Glazing."
- F. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, resilient glazing gaskets, setting blocks, and shims or spacers, fabricated from an elastomer of type and in hardness recommended by system and gasket manufacturer to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- G. Spacers, Setting Blocks, Gaskets, and Bond Breakers: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- H. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- I. Sealants and joint fillers for joints at perimeter of entrance and storefront systems as specified in Division 7 Section "Joint Sealants."
- J. Bituminous Paint: Cold-applied asphalt-mastic paint complying with SSPC-Paint 12 requirements, except containing no asbestos, formulated for **30-mil** thickness per coat.

2.3 COMPONENTS

- A. Doors: Provide manufacturer's standard **1-3/4-inch-** thick glazed doors with minimum **0.125-inch-** thick, extruded tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deep penetration and fillet welded or that incorporate concealed tie-rods.
 - 1. Glazing Stops and Gaskets: Provide manufacturer's standard snap-on extruded-aluminum glazing stops and preformed gaskets.
 - 2. Stile Design: Medium stile; **3-1/2-inch** nominal width.
- B. Brackets and Reinforcements: Provide manufacturer's standard brackets and reinforcements that are compatible with adjacent materials. Provide nonstaining, nonferrous shims for aligning system components.

- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
- D. Weather Stripping: Manufacturer's standard replaceable weather stripping as follows:

2.4 HARDWARE

- A. General: Provide heavy-duty hardware units indicated in sizes, number, and type recommended by manufacturer for entrances indicated. Finish exposed parts to match door finish, unless otherwise indicated.
- B. Ball-Bearing Butts: ANSI/BHMA A156.1, Grade 1, 5-knuckle, 4-1/2-by-4-inch ball-bearing butts. Provide nonremovable pins at hinges exposed to door outside and provide nonferrous hinges for applications exposed to weather. Provide 3 hinges at each leaf for doors up to 36 inches wide and 80 inches tall; provide 4 hinges at each leaf for taller doors.
- C. Closers, General: Comply with manufacturer's recommendations for closer size, depending on door size, exposure to weather, and anticipated frequency of use.
 - 1. Closing Cycle: Comply with requirements of authorities having jurisdiction or the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," whichever are more stringent.
 - 2. Opening Force: Comply with the following maximum opening-force requirements for locations indicated:
 - a. Exterior Doors: 15 lbf.
- D. Surface-Mounted Overhead Closers: ANSI/BHMA A156.4, Grade 1. Provide cover and the following:
 - 1. Mounting: Parallel arm.
 - 2. Hold Open: Automatic, at angle selected by Architect from manufacturer's standard options.
 - 3. Hold Open: None.
 - 4. Back Check: Adjustable.
- E. Door Stops: ANSI/BHMA A156.16, Grade 1, floor- or wall-mounted door stop, as appropriate for door location indicated, with integral rubber bumper.
- F. Cylinders: As specified in Division 8 Section "Door Hardware."
- G. Thumb Turns: Manufacturer's standard cast-aluminum-alloy, inside thumb-turn cylinders.
- H. Cylinder Guard: Manufacturer's standard hardened-steel security ring with retainer plate for inside stile wall that protects lock cylinder from removal by wrenches, prying, or sawing.
- I. Deadlock: Manufacturer's standard mortise deadlock with minimum 1-inch- long throw bolt and complying with ANSI/BHMA A156.5, Grade 1 requirements.
 - 1. Two-Point Locking: Provide bottom bolt and mechanism that automatically throws active-leaf bottom bolt into threshold when deadlock engages inactive leaf and provides one-stage unlocking.
- J. Lockset Faceplates: Manufacturer's standard extruded-aluminum faceplate for lock type indicated that lays flush with door stile.
 - 1. Provide radiused faceplate with weather sweep extending full length of lock at meeting stiles of pairs of doors.

- K. Manual Flush Bolts: ANSI/BHMA A156.16, edge-mortised, lever-extension-type flush bolts.
 - 1. Locate flush bolts at bottom of inactive leaf of pairs of doors.
 - 2. Locate flush bolts at top and bottom of inactive leaf of pairs of doors.
- L. Vertical-Rod Exit Devices: Concealed, vertical-rod exit device complying with UL 305 requirements, with 2-point top and bottom latching that is released by a latch-releasing push-panel mechanism recessed into door crossrail or when locked down (dogged) by lock cylinder or retracting screws beneath housing.
- M. Pull Handles: As selected by Architect from manufacturer's full range of pull handles and plates.
- N. Thresholds: At exterior doors, provide manufacturer's standard threshold with cutouts coordinated for operating hardware, with anchors and jamb clips, and not more than **1/2-inch**-high, with beveled edges providing a floor level change with a slope of not more than 1:2, and in the following material:
 - 1. Material: Aluminum, mill finish.
- O. Weather Sweeps: Manufacturer's standard weather sweep for application to exterior door bottoms and with concealed fasteners on mounting strips.
- P. Finger Guards: Collapsible neoprene or PVC gasket anchored to frame hinge-jamb of center-pivoted doors.

2.5 FABRICATION

- A. General: Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.
 - 1. Fabricate components for screw-spline frame construction.
- B. Forming: Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
- C. Prepare components to receive concealed fasteners and anchor and connection devices.
- D. Fabricate components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- E. Welding: Weld components to comply with referenced AWS standard. Weld before finishing components to greatest extent possible. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- F. Glazing Channels: Provide minimum clearances for thickness and type of glass indicated according to FGMA's "Glazing Manual."
- G. Glazing Channels: Provide minimum clearances for thickness and type of plastic sheet indicated according to plastic sheet manufacturer's written instructions.
- H. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- I. Storefront: Fabricate framing in profiles indicated for flush glazing (without projecting stops). Provide subframes and reinforcing of types indicated or, if not indicated, as required for a complete system. Factory assemble components to greatest extent possible. Disassemble components only as necessary for shipment and installation.
- J. Entrances: Fabricate door framing in profiles indicated. Reinforce as required to support imposed loads. Factory assemble door and frame units and factory install hardware to greatest extent possible. Reinforce door and frame units as required for installing hardware indicated. Cut, drill, and tap for factory-installed hardware before finishing components.
 - 1. Exterior Doors: Provide compression weather stripping at fixed stops. At other locations, provide sliding weather stripping retained in adjustable strip mortised into door edge.

2.6 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
 - 1. Scratches and similar surface damage are not acceptable.
- C. Finish designations prefixed by AA conform to the system established by the Aluminum Association for designating aluminum finishes.
- D. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 607.1.
 - 1. Anodized Aluminum

2.7 STEEL PRIMING

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying primer.
- B. Surface Preparation: Perform manufacturer's standard cleaning operations to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.
- C. Priming: Apply manufacturer's standard corrosion-resistant primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of entrance and storefront systems. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing entrance and storefront systems. Do not install damaged components. Fit frame joints to produce hairline joints free of burrs and distortion. Rigidly secure nonmovement joints. Seal joints watertight.
- B. Metal Protection: Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints and condensation and moisture occurring or migrating within the system to the exterior.
- D. Set continuous sill members and flashing in a full sealant bed to provide weathertight construction, unless otherwise indicated. Comply with requirements of Division 7 Section "Joint Sealants."
- E. Install framing components plumb and true in alignment with established lines and grades without warp or rack of framing members.
- F. Install entrances plumb and true in alignment with established lines and grades without warp or rack. Lubricate operating hardware and other moving parts according to hardware manufacturers' written instructions.
- G. Install glazing to comply with requirements of Division 8 Section "Glazing," unless otherwise indicated.
- H. Install perimeter sealant to comply with requirements of Division 7 Section "Joint Sealants," unless otherwise indicated.
- I. Erection Tolerances: Install entrance and storefront systems to comply with the following maximum tolerances:
 - 1. Variation from Plane: Limit variation from plane or location shown to **1/8 inch in 12 feet; 1/4 inch** over total length.
 - 2. Alignment: Where surfaces abut in line, limit offset from true alignment to **1/16 inch**. Where surfaces meet at corners, limit offset from true alignment to **1/32 inch**.
 - 3. Diagonal Measurements: Limit difference between diagonal measurements to **1/8 inch**.

3.3 FIELD QUALITY CONTROL

- A. Repair or remove and replace Work that does not meet requirements or that is damaged by testing; replace to conform to specified requirements.

3.4 ADJUSTING AND CLEANING

- A. Adjust doors and hardware to provide tight fit at contact points and weather stripping, smooth operation, and weathertight closure.
- B. Remove excess sealant and glazing compounds, and dirt from surfaces.

3.5 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure entrance and storefront systems are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 08410

SECTION 087100 – FINISH HARDWARE**PART 1 – GENERAL:****1.01 SUMMARY:**

- A. Section includes Finish Hardware
- B. Work under this section comprises of furnishing and installing hardware specified herein and noted on drawings for a complete and operational system, including all required mechanical and electrified hardware components, systems and controls. All doors that are fire rated shall be provided with fire rated hardware to comply with the local code requirements. The general contractor and hardware supplier shall coordinate cylinder types with all door manufacturers prior to submittal of finish hardware. There will be no additional change orders issued due to the general contractor or hardware supplier's failure to include any hardware item required by local code or required for functional and/or proper installation of hardware items due to failure to coordinate with other trades and/or related products.
- C. The General Contractor and Hardware Supplier shall notify the Architect in writing of any discrepancies five (5) days prior to bid date that could and/or would result in hardware being supplied that is none functional, hardware specified and/or hardware that has not been specified that will result in any code violations and any door that is not covered in this specification. Failure of the general contractor and hardware supplier to address any such issue shall be considered acceptance of the hardware specified and all discrepancies shall be corrected at the general contractor and hardware supplier's expense and considered a part of their base bid. Change orders shall not be issued if deemed by the Architect to fall under and/or be covered as a part of the supplier's base bid, due to failure to comply with this instruction notification.
- D. Items include but are not limited to the following:
 - 1. Hinges - Pivots
 - 2. Flush Bolts
 - 3. Exit Devices
 - 4. Locksets and Cylinders, Cores, Keys
 - 5. Push Plates - Pulls
 - 6. Coordinators
 - 7. Closers
 - 8. Kick, Mop and Protection Plates
 - 9. Stops, Wall Bumpers, Overhead Controls
 - 10. Electrified Hold Open Devices
 - 11. Thresholds, Gasketing and Door Bottoms
 - 12. Silencers
 - 13. Miscellaneous Trim and Accessories
 - 14. Mounting Plates, Brackets, Fasteners
 - 15. Electrified Hardware Items, Controls and Power Supplies
 - 16. Wiring diagrams
 - 17. Wire and Communication Cable (Furnish & Install)
 - 18. Installation & Testing of the Complete Access Control System
- E. Related Sections:
 - 1. Finish Carpentry – Division 6
 - 2. Metal Doors and Frames – Division 8
 - 3. Wood Doors – Division 8

4. Aluminum Storefront – Division 8
5. Acoustically Gasketed Doors – Division 8
6. Electrical - Division 16

1.02 REFERENCES:

- A. Documents and Institutes that shall be used in estimating, detailing and installing the items specified.
 1. International Building Code – Current Edition
 2. ICC/ANSI A117.1 – Accessible and Usable Building and Facilities – Current Edition
 3. NFPA80 –Standards For Fire Doors and Fire Windows – Current Edition
 4. NFPA101 – Life Safety Code – Current Edition
 5. NFPA105 – Installation of Smoke-Control Door Assemblies – Current Edition.
 6. UL Labeled for Rated Doors.
 7. DHI – Door and Hardware Institute
 8. SDI- Steel Door Institute
 9. ANSI - American National Standards Institute
 10. BHMA – Builders Hardware Manufacturers Association
 11. Local Building Codes
 12. Leed – version 2.2

1.03 SUBMITTALS

- A. Comply with pertinent provisions of Section 01300.
- B. Finish Hardware Schedule to be in vertical format to include:
 1. Heading #/Hardware Set
 2. Door #, Location, Hand, Degree of Opening, Door Size and Type, Frame Size and Type, Fire Rating
 3. Quantity, type, style, function, product, product number, size, fasteners, finish and manufacturer of each hardware item.
 4. Location of hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.
 5. Keying schedule
 6. Title Sheet, Index, Abbreviations, Manufacturers List, Template List and Templates.
 7. Mounting locations for hardware.
 8. Explanation of abbreviations, symbols, and codes contained in schedule.
- C. Product Data: Product data shall be provided, in the form of a binder, manufacturer's technical product fact sheets for each item of hardware. Include whatever information may be necessary to show compliance with requirements, including instructions for installation and for maintenance of operating parts and finish.
- D. Wiring Diagrams: Riser/Elevation and Point to Point Wiring Diagrams shall be provided. Include whatever information may be necessary for coordination with other trades.
- E. Samples: Samples shall be provided as requested by owner or architect with Heading # and Door# marked on boxes. All samples shall be returned to the contractor and used on doors for which they were marked
- F. Templates: Templates of finish hardware items to be supplied are to be furnished to each fabricator of doors, frames and other work to be factory-prepared for the installation of hardware.

- G. Keying Schedule: A keying schedule shall be submitted using keyset symbols referenced in DHI manual "Keying Systems and Nomenclature." The keying schedule shall be indexed by door number, keyset, hardware heading number, cross keying instructions and special key stamping instructions.
- H. Operations and maintenance data: At the completion of the job, furnish to the owner two copies of an owner's operation and maintenance manual. The manual shall consist of a labeled hardcover three ring binder with the following technical information:
 - 1. Title page containing: Project name, address and phone numbers. Supplier's name, address and phone numbers.
 - 2. Table of Contents.
 - 3. Copy of final Finish Hardware Schedule and Keying Schedule
 - 4. Maintenance instruction for each item of hardware.
 - 5. Catalog pages for each product.
 - 6. Installation Instructions and Parts List for all Locks, Exit Devices and Door Closers.

1.04 QUALITY ASSURANCES

- A. Substitutions: Request for substitutions shall not be accepted within this project. Architect, owner and Hardware Consultant have selected one (1) specified and two (2) equals listed hereinafter in the Hardware Schedule. By this selection process they have established three (3) equal products for competitive pricing, while insuring no unnecessary delays by a substitution process. If any specified product is listed as a "No Substitution" product, this product will be supplied as specified, with no alteration or request of substitution. The reason for this is to comply with the uniformity established at this project. Parts and supplies are inventoried for these particular products for ease and standardization of replacement.
- B. Supplier Qualifications: Supplier shall be recognized architectural finish hardware supplier, who have been furnishing hardware in a 100 mile radius of the project for a period of not less than 2 years with complete stocking warehouse, service, and locksmith shop facilities, who shall employ a DHI Certified AHC (Architectural Hardware Consultant) or AOC (Architectural Openings Consultant) on staff. This person shall be available at reasonable times during the course of the work for consultation about products hardware requirements, to the owner, architect and contractor.
- C. Installation Review: A Distributor Representative (AHC) shall perform a jobsite walk-through after completion of installation in order to review correct installation, adjustment, hardware applications and to verify that the correct hardware has been installed at the correct doors.
- D. Installer Qualifications: Installer for mechanical hardware shall have a minimum of 2 years of experience of installing architectural finish hardware and attend a pre-installation meeting with the manufacturer's representative of locks, exit devices and closers.
- E. Installer Qualifications (Electrified Hardware): All electrified finish hardware (power, load, switch, conductor and monitoring device) shall be installed by an Electronic Access Control installer licensed by the Texas Department of Public Safety. The electrified finish hardware installer shall have a minimum of at least two (2) years of documented experience. Installer shall attend a pre-installation meeting between the contractor, finish hardware supplier, electrical contractor, fire alarm contractor,

security contractor, hardware manufacturers representative for locks, closers and exit devices, all door / frame suppliers. The electrified finish hardware installer shall be responsible for the proper installation and function of all doors and hardware. Installation shall include wiring all electrified products (including the required wire to the power supply and/or junction box).

1.05 DELIVERY, STORAGE AND HANDLING

- A. Marking and packaging: Mark each item or package separately, with identification related to hardware set number, door number and keyset symbol.
- B. Delivery:
 1. Deliver individually packaged and properly marked finish hardware at the proper time and location to avoid any delays in construction or installation.
 2. At time of delivery, inventory hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- C. Storage: Store hardware in enclosed, dry and locked area.

1.06 WARRANTY

- A. All finish hardware products shall be covered by a 1 year factory warranty from the date of substantial completion of the project.
- B. Supply warranty verification to the owner for products that provide factory warranties for periods longer than one year. Mechanical Door Closers shall carry a 10-year warranty.

1.07 MAINTENANCE:

- A. Maintenance Service
 1. None
- B. Extra Materials:
 1. Furnish 3 dozen extra screws and other fasteners of each size, type and finish used with the hardware items provided. These screws and fasteners are to be delivered to the hardware installer for use during installation. All extra screws and fasteners and all special installation tools furnished with the hardware shall be turned over to the owner at the completion of the job.
 2. All installation tools provided by the manufacturers shall be turned over to the owner at the completion of the job.
 3. Operation and Maintenance Manual: Prior to substantial completion, provide a three ring binder containing the information listed below for Owner's use.

Manual shall be submitted to Architect for approval prior to delivery to Owner.
 Title page containing project name, supplier's name, address and phone number
 As built finish hardware schedule including final keying
 Product data
 Manufacturer's recommended maintenance instructions
 Manufacturer's published warranty information
 Manufacturer's installation instructions
 Manufacturer's parts manuals for locks, latches, exit devices and door closers
 As built riser diagrams and point to point wiring diagrams

PART 2 – PRODUCTS

2.01 MANUFACTURER

A.	Manufacturer	Location	Abbreviation	Website
	Bommer Industries, Inc.	Landrum, SC	BOM	www.bommer.com
	Doromatic	Princeton, IL	COR	www.doromatic.com
	Falcon	Security, CO	FAL	www.falconlock.com
	Glynn Johnson	Indianapolis, IN	GLY	www.glynn-johnson.com
	Hager Hinge Company	St Louis, MO	HAG	www.hagerhinge.com
	Ives	Indianapolis, IN	IVE	www.iveshardware.com
	LCN	Princeton, IL	LCN	www.lcnclosers.com
	Monarch	Sheperdsville, KY	MON	www.monarchhardware.com
	National Guard	Memphis, TN	NGP	www.ngpinc.com
	Pemko	Ventura, CA	PEM	www.pemko.com
	Rockwood	Rockwood, PA	ROC	www.rockwoodmfg.com
	Schlage	Security, CO	SCH	www.schlage.com
	Trimco/BBW/Quality	Los Angeles, CA	TRI	www.trimcobbw.com
	Von Duprin	Indianapolis, IN	VON	www.vonduprin.com

2.02 MATERIALS

- A. Screws and Fasteners:
 - 1. Closers and exit devices provided for exterior doors shall be provided with thru-bolts.
 - 2. All finish hardware shall be installed to manufacturer’s recommendations, using screws, attachments and installation tools provided with the hardware. No other screws or attachments are acceptable.
 - 3. All other products to meet door and frame conditions.

- B. Hinges:
 - 1. Template: Provide templated units only.
 - 2. Exterior: All exterior hinges shall be standard weight (.134 or .146 ga) five knuckle, ball bearing, full mortise type, stainless steel.
 - 3. Interior: All interior hinges shall be standard weight (.134 or .146 ga) five knuckle, ball bearing, full mortise type.
 - 4. Provide non-removable pins for all outswinging exterior and interior doors to receive locking hardware (whether indicated or not) at individual HW Sets in the schedule.
 - 5. Size: Provide 4 ½ x 4 ½ hinges on doors up to 3’0” in width. Provide 5 x 4 ½ hinges on door from 3’2” to 4’0” in width. Reference manufacturers catalog for all other sizes.
 - 6. Number of Hinges: Provide number of hinges indicated but not less than 3 hinges for door leaf for doors 90” or less in height and one additional hinge for each 30” of additional height.
 - 7. The width of hinge shall be sufficient to clear all trim.
 - 8. Supply from the following list of manufacturers:
 - Ives
 - Hager
 - Bommer

- C. Flush Bolts
 - 1. Provide constant latching flush bolts that remains latched until the door is opened, then the top bolt can be manually released. The bottom bolt is automatic as shown in hardware sets

2. UL listed for fire doors as required.
3. Fits standard ANSI A115.4 Door and Frame preparation.
4. Meets ANSI156.3, Type 27
5. As codes and conditions permit, provide on the inactive door of pairs, extension flush bolts at top of doors. Provide all necessary strikes, shim and guides to insure proper installation.
6. Supply from the following manufacturer:
Ives
Trimco
Rockwood

D. Coordinator

1. Provide coordinator that is a bar type.
2. UL listed for fire doors.
3. Meets ANSI/BHMA A156.3, Type 21A
4. Supply from the following manufacturer:
Ives
Trimco
Rockwood

E. Cylindrical Locks/Latches

1. Provide cylindrical locksets that comply with ANSI A156.2, Series 4000, Grade 2
2. Provide cylindrical locksets that meet ANSI A117.1, Accessibility Code.
3. Provide cylindrical locksets that meet UL A label; to have a minimum listing for single doors 4' x 8'
4. Provide cylindrical locksets that comply with California Fire Safety Code; lever return to within 1/2" of the door where applicable.
5. Lockset to have the ability to incorporate either a rigid or free-wheeling lever when in locked mode where shown in hardware sets.
6. Chassis to be field-changeable to free-wheeling lever.
7. Chassis to be one-piece, modular assembly.
8. Chassis to be multi-functional; interchange of function assembly without disassembly of lockset.
9. Spindle to be deep-draw manufactured. Manufacturers utilizing stamped spindles are not acceptable.
10. Spring Cage to have double compression springs. Manufacturers utilizing torsion springs are not acceptable.
11. Spindle and Spring Cage (internal) to be one-piece integrated assembly.
12. Levers to be bi-directional, independent assemblies.
13. Levers to be free-wheeling when locked where shown in hardware sets.
14. Levers are to be solid. Manufacturers utilizing fillers of any kind are not acceptable.
15. Levers are to be plated to match BHMA finishes.
16. Anti-rotation plate to be interlocking to lock chassis. Manufacturers utilizing anti-rotation plates with bit-tabs are not acceptable.
17. Thru-bolts to be a minimum of 1/4" in diameter.
18. Thru-bolts to secure anti-rotation plate without sheer line. Manufacturers utilizing fully threaded thru-bolts are not acceptable.
19. Adjustment plate to be threaded for door thickness adjustment.
20. Adjustment plate to adjust for doors from 1 5/8" thickness to 2 1/8" thickness.
21. Adjustment plate to have visual chassis marking for doors 1 3/4" thick.
22. Latchbolt to be steel with minimum 1/2" throw deadlatch on keyed and exterior functions; 3/4" throw anti-friction latchbolt on pairs of doors.
23. Strike to be ANSI curved lip, 1 1/4" x 4 7/8", 16 gauge, with 1" deep box construction.

24. All locksets and cylinders are to be provided by the same manufacturer, unless otherwise specified.
25. Supply from the following list of manufacturers:
Schlage – ND
Sargent – 11 line
Hager (Equivalent Models to be submitted for consideration)

F. Exit Devices

1. All exit devices are to be architectural grade touch bar type. Mechanism case to be smooth.
2. All exit devices to meet ANSI A156.3, 1994, Grade 1. All exit devices are UL listed for Accident Hazard or Fire Exit Hardware.
3. All lever trim to match lock trim in design and finish.
4. Dogging: All non-rated devices are to be provided with dogging. Cylinder dogging as shown in hardware sets.
5. All devices are to be supplied and installed with thru-bolts.
6. Mullion shall be removable. Keyed removable as shown in hardware sets.
7. All push pads shall be metal, no plastic inserts allowed.
8. Function and type as listed in hardware sets.
9. All exit devices are to be provided by the same manufacturer, unless otherwise specified.
10. Supply from the following list of manufacturers:
Von Duprin 99 Series (Von Duprin XP99 where indicated – no substitution)
Sargent 80 Series

G. Pull Plates

1. Pull Plates to meet ANSI 156.6 for .050" thickness. Plate size to 4" x 16" with 1" round on pull plate.
2. Supply from the following list of manufacturers
Ives
Trimco
Rockwood

H. Push Plates

1. Push Plates to meet ANSI 156.6 for .050" thickness. Plate size to be 4" x 16".
2. Supply from the following list of manufacturers
Ives
Trimco
Rockwood

I. Door Closers

1. Door closers shall meet the minimum requirements of the 1990 ADA act, in lieu of ANSI Standard A156.4 and ANSI, Grade 1.
2. Door closers shall be furnished with full cover. Sized in accordance with the manufacturers recommendations for door size and condition.
3. Door closers shall be furnished with backcheck, delayed action, hold-open and advanced backcheck as listed in the Hardware Schedule.
4. Door closers shall be mounted out of the line of sight wherever possible (i.e., room side of corridor doors, etc.) with parallel arm mounting on out swinging doors. Mount closer top jamb or on brackets and/or drop plates, where special conditions call for it. All closer installation on wood doors shall include sex nut bolts.
5. Supply from the following list of manufacturers
LCN 1460/4040 (4040XP where indicated – no substitution)
Norton 7500/8500

Hager (Equivalent Models to be submitted for consideration)

- M. Door Protection Plates
 - 1. Protective plates shall meet ANSI A156.6 requirements for .050 thickness.
 - 2. Kickplates shall be 10" by 2" less than door width on single door and 1" less than door width on pair of doors or as indicated in hardware sets. Beveled 3 edges.
 - 3. Armor plates shall be 34" by 2" less than door width or as indicated in hardware sets. Beveled 4 edges.
 - 4. Supply from the following list of manufacturers:
Ives
Rockwood
Trimco

- N. Door Stops and Holders:
 - 1. Wall and Floor Stops: Supply wall stops where needed to protect doors or door hardware. When wall conditions do not permit use of wall stop provide floor stops with risers as needed to adjust for floor conditions.
 - 2. Overhead Stops: Where wall or floors stops are not applicable provide surface overhead stops.
 - 3. Supply from the following list of manufacturers:
Ives
Glynn Johnson
Trimco

- O. Silencers
 - 1. Provide silencers on all doors without smoke seal or weatherstrip. 3 for single doors and 2 for pairs.
 - 2. Provide silencers as required for frame conditions
 - 3. Supply from the following list of manufacturer's
Ives
Rockwood
Trimco

- P. Thresholds/Weatherstripping
 - 1. All thresholds shall conform to state and local handicap codes.
 - 2. Smoke seal shall be teardrop design bulb seal.
 - 3. Perimeter seal shall be vinyl.
 - 4. Drip strips shall protrude 2 1/2".
 - 5. Provide door sweeps with drip cap.
 - 6. Provide UL meeting stile gasketing for fire rated doors.
 - 7. Supply from the following list of manufacturer's
National Guard
Hager
Pemko

2.03 FINISHES

CATEGORY	FINISH
Butts	
Interior Non Labeled	652
Interior Labeled	652
Interior Corrosive Area	630
Exterior	630
Flush Bolts/Dust Proof Strikes	626
Locks/Latches	626

Cylinders	626
Exit Devices	626
Door Closers	689
Push Plates	630
Pull Plates	630
Protective Plates	630
Door Stops and Holders	626
Overhead Stops/ Holders	630
Weatherstrip and Threshold	628

2.04 KEYING:

- A. General: Supplier will meet with owner to finalize keying requirements and match existing Schlage conventional Master Key System for the project.
- B. Keys: Provide nickel silver keys only. Furnish (3) change keys per lock/cylinder: 6 masterkeys (per set): 3 grand masterkeys total. Deliver all keys to owners' representative.

2.05 KEY CONTROL:

- A. Key Management: Provide a complete key storage and management system. Each key shall be fully cut, indexed, tagged and installed on cabinet hooks by the lock supplier and shipped with the locks. Key cabinet provided shall be wall-mounted type with capacity plus 50%.

2.06 KNOX BOX:

- A. Provide 3200-Series with swinging door and mortise kit "RMK" as manufactured by The Knox Company (See architectural drawings for location).

PART 3 – EXECUTION:

3.01 EXAMINATION:

- A. Examine doors, frames and related items for conditions that would prevent the proper application of any finish hardware items. Do not proceed with installation until all defects are corrected.

3.02 INSTALLATION:

- A. Follow Door and Hardware Institute Publication for:
 Recommended Location for Architectural Hardware for Standard Steel Doors and Frames
 Recommended Location for Builder's Hardware for Custom Steel Doors and Frames
 Recommended Locations for Architectural Hardware for Wood Flush Door
- B. Follow ANSI A117.1-1998 Accessible and Usable Building and Facilities
- C. Review mounting locations with Architect.
- D. Pre Installation meeting required with attendees to include Architect, Contractor, Carpenter, Supplier and Manufacturer's Representative for Exit Device, Locks and Closers before installation begins.
- E. Provide shims as required to ensure exit device does not conflict with trim or moldings on door face.

- F. Preload (Index) all Door Closer arms (as demonstrated on provided installation instructions) "prior to" fine-tuning valve adjustments.
- G. Contractor to provide wood blocking for wall stops, magnetic holders and all wall mounted hardware where required (based on wall construction) for protection of both; walls and hardware.

3.03 FIELD QUALITY CONTROL:

- A. Installation Review: A Distributor Representative (AHC) shall perform a jobsite walk-through after completion of installation in order to review correct installation, adjustment, hardware applications and to verify that the correct hardware has been installed at the correct doors.

3.04 ADJUST AND CLEAN:

- A. Adjust, clean and inspect all hardware, to ensure proper operation and function of every opening. Replace items, which cannot be adjusted to operate freely and smoothly as intended for the application made.

3.05 PROTECTION:

- A. The contractor shall use all means at his disposal to protect all finish hardware items from abuse, corrosion and other damage until the owner accepts the project as complete.

3.06 HARDWARE SCHEDULE

GENERAL NOTES:

1. Provide appropriate door stops for each application, regardless of what is shown in the individual hardware sets. Provide OH Stops where required. Provide wall stops when possible, unless otherwise indicated.
2. Provide appropriate drop plates, closer arms, brackets, fasteners, miscellaneous items as required for a complete/proper installation of hardware.

HW SET: 01 PAIR EXTERIOR SF ENTRY

DOOR NUMBER:

100

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	224HD -DOOR HEIGHT REQUIRED	628	IVE
2	EA	PANIC HARDWARE	3347A-NL-OP SNB	626	VON
2	EA	RIM CYLINDER	20-022	626	SCH
2	EA	OFFSET DOOR PULL	8190-0-O	630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH SNB	689	LCN
2	EA	MOUNTING PLATE	4040-18PA	689	LCN
1	EA	THRESHOLD	AS DETAILED	AL	NGP
2	EA	DOOR SWEEP	200NA-LENGTH AS REQUIRED	AL	NGP
1	EA	DRIP CAP	16A-FRAME WIDTH PLUS 4" (WHERE REQD)	AL	NGP

BALANCE HARDWARE BY DOOR MFG

BYO

HW SET: 02 PAIR EXTERIOR HM ENTRY

DOOR NUMBER:

107A 107B 108

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	224HD -DOOR HEIGHT REQUIRED	628	IVE
2	EA	PANIC HARDWARE	9949NL-OP SNB	626	VON
2	EA	RIM CYLINDER	20-022	626	SCH
2	EA	OFFSET DOOR PULL	8190-0-0	630	IVE
2	EA	SURFACE CLOSER	4040XP SCUSH SNB	689	LCN
1	EA	THRESHOLD	AS DETAILED	AL	NGP
1	SET	ASTRAGAL	9605-HEIGHT AS REQD	AL	NGP
1	SET	SEALS	120NS	AL	NGP
2	EA	DOOR SWEEP	200NA-LENGTH AS REQUIRED	AL	NGP
1	EA	DRIP CAP	16A-FRAME WIDTH PLUS 4" (WHERE REQD)	AL	NGP

HW SET: 03 PAIR INTERIOR – PANICS

DOOR NUMBER:

107C

EACH TO HAVE:

6	EA	HINGES	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	PANIC HARDWARE	9927-L #17 LBR SNB	626	VON
2	EA	RIM CYLINDER	20-022	626	SCH
2	EA	SURFACE CLOSER	4040XP RW/PA SNB	689	LCN
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	FLOOR/WALL	FS13/WS407CCV (AS REQD)	626	IVE
1	SET	SEALS	9850 OR 2525 (AS REQUIRED BY DR MFG)	BRN	NGP
1	SET	ASTRAGAL	9605A-HEIGHT AS REQ'D	628	NGP

HW SET: 04 SGL STORAGE LOCK (OH STOP WHERE REQD)

DOOR NUMBER:

101 111 114 115A

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	OH STOP	GJ450S SNB	630	GLY
1	EA	FLOOR/WALL	FS13/WS407CCV (AS REQD)	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

NOTE: OH STOP @ DOOR 114

HW SET: 05 SGL OFFICE LOCK

DOOR NUMBER:

102A 102B 103 104 109 113A

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	OFFICE LOCK	ND53PD SPA	626	SCH
1	EA	FLOOR/WALL	FS13/WS407CCV (AS REQD)	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 06 SGL PUSH/PULL/CLOSER/KICKPLATE

DOOR NUMBER:

110 112

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5	630	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8303-8 4" X 16"	630	IVE
1	EA	CLOSER	1461 RW/PA SNB	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	FLOOR/WALL	FS13/WS407CCV (AS REQD)	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 07 PAIR STOREROOM LOCK (PR@6'0"x7'0")

DOOR NUMBER:

106 106

EACH TO HAVE:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	FLUSH BOLT	FB458-12"	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
2	EA	OH HOLDERS	GJ450H SNB	630	GLY
1	EA	ASTRAGAL	139SP X 5050B-HEIGHT AS REQD	600	NGP
2	EA	SILENCER	SR64	GRY	IVE

HW SET: 07.1 PAIR STOREROOM LOCK (MEZZ STOREROOMS) PR@6'0"x4'0"

DOOR NUMBER:

201 202

EACH TO HAVE:

4	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	652	IVE
2	EA	FLUSH BOLT	FB458-12"	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
2	EA	OH HOLDERS	GJ450H SNB	630	GLY

1	EA	ASTRAGAL	139SP X 5050B-HEIGHT AS REQD	600	NGP
2	EA	SILENCER	SR64	GRY	IVE

HW SET: 08 SGL EXTERIOR STORAGE

DOOR NUMBER:

113B

EACH TO HAVE:

3	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
1	EA	SURFACE CLOSER	4040XP SHCUSH SNB	689	LCN
1	EA	THRESHOLD	AS DETAILED	AL	NGP
1	SET	SEALS	120NS	AL	NGP
1	EA	DOOR SWEEP	200NA-LENGTH AS REQUIRED	AL	NGP
1	EA	DRIP CAP	16A-FRAME WIDTH PLUS 4" (WHERE REQD)	AL	NGP

HW SET: 09 PAIR EXTERIOR STORAGE

DOOR NUMBER:

115B

EACH TO HAVE:

6	EA	HINGE	5BB1HW 4.5 X 4.5 NRP	630	IVE
2	EA	FLUSH BOLT	FB458-12" (BOTTOM)	626	IVE
1	EA	DUST PROOF STRIKE	DP2	626	IVE
1	EA	STOREROOM LOCK	ND80PD SPA	626	SCH
2	EA	SURFACE CLOSER	4040XP SHCUSH SNB	689	LCN
1	EA	THRESHOLD	AS DETAILED	AL	NGP
1	EA	ASTRAGAL	139SP X 2525B-HEIGHT AS REQD	600	NGP
1	SET	SEALS	120NS	AL	NGP
2	EA	DOOR SWEEP	200NA-LENGTH AS REQUIRED	AL	NGP
1	EA	DRIP CAP	16A-FRAME WIDTH PLUS 4" (WHERE REQD)	AL	NGP

HW SET: 10 COILING SHUTTERS

DOOR NUMBER:

113C 113D

EACH TO HAVE:

2	EA	M. CYLINDER	20-013 (OR AS REQUIRED)	626	SCH
		BALANCE HARDWARE	BY DOOR MFG		BYO

MISC ITEMS

PROVIDE THE FOLLOWING:

		(1) XTRA KY PER CYL	KEY		SCH
		(3) GMKYS	KEY		SCH
		(6) MKYS (PER SET)	KEY		SCH
1	EA	KEY STAMPING	STAMPING (AS DIRECTED BY OWNER)		SCH
1	EA	KEY CABINET	1200-SERIES (PLUS 50% CAPACITY)	GRY	LUN
1	EA	KNOX BOX	3200-SERIES X RMK (HINGED DOOR)	BLK	KNO
1	EA	FACTORY BITTING LIST			
1	EA	HARDWARE SCHEDULE			
1		INSTALLATION REVIEW	BY DISTRIBUTOR AHC, AFTER INSTALLATION		

END OF SECTION 087100

SECTION 08800 - GLAZING**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.

1.2 QUALITY ASSURANCE

- A. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
 - 1. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 PRIMARY FLOAT GLASS

- A. Float Glass: ASTM C 1036, Type I (transparent glass, flat), Quality q3 (glazing select); class as indicated in schedules at the end of Part 3.

2.2 ACCENT GLASS

- A. Reserved

2.3 ELASTOMERIC GLAZING SEALANTS

- A. General: Provide products of type indicated, complying with the following requirements:
 - 1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2.4 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing standard, to comply with system performance requirements.
- B. Grind smooth and polish exposed glass edges.

PART 3 - EXECUTION

3.1 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

- B. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- C. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- D. Provide spacers for glass lites where the length plus width is larger than 50 inches as follows:
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- E. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- F. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

3.2 PROTECTION AND CLEANING

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.
- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build-up of dirt, scum, alkaline deposits, or stains; remove as recommended by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents, and vandalism, during construction period.
- E. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

3.3 GLAZING SCHEDULE

- 1. Tempered glass: 1/4" thick, clear, type FG-C, ASTM C1036 type 1, class 3, quality q3, horizontal tempering
- 2. Insulating glass: 1" thick, 1/4" PPG Solarban 60 Solar Control Low-E Atlantica and clear, heat strengthened /1/2" air space/ 1/4" bronze heat strengthened; tempered as required by Building Code.
Summer U-Value = 0.27, Solar Heat Gain Coefficient = 0.27, Shading Coefficient = 0.32
Visible Light Transition = 53%.
- 3. Mirrored Glass: 1/4" thick clear, polished edges, chrome clips, mastic to wall.

END OF SECTION 08800

SECTION 09260 - GYPSUM BOARD ASSEMBLIES**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.

1.2 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For the following products:
 - 1. Textured Finishes: Submit two (2) textured samples 26" x 26" scheduled texture with 1/2 of sample painted for final selection of texture by Architect. Finish indicated on schedule and on same backing indicated for Work.

1.4 QUALITY ASSURANCE

- A. Sound Transmission Characteristics: For gypsum board assemblies with STC ratings, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

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:

1. Gypsum Board and Related Products:
 - a. G-P Gypsum Corp.
 - b. National Gypsum Company.
 - c. USG Corporation
 - d. Georgia Pacific

2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.0625-inch-** diameter wire, or double strand of **0.0475-inch-** diameter wire.
- C. Hangers: As follows:
 1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, **0.162-inch** diameter.
 2. Rod Hangers: **ASTM A 510**, mild carbon steel.
 - a. Diameter: **1/4-inch.**
 3. Isolation Hanger : Kinetics Model ICC Isolation Hanger; Kinetics Noise Control; (877) 457-2695
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of **0.0538 inch**, a minimum **1/2-inch-** wide flange.
- E. Furring Channels (Furring Members): Commercial-steel sheet with zinc coating.
 1. Cold Rolled Channels: **0.0538-inch** bare steel thickness, with minimum **1/2-inch-** wide flange, **3/4 inch** deep.
 2. Steel Studs: ASTM C 645.
 - a. Minimum Base Metal Thickness: 25 ga.
 - b. Depth: As indicated - **2-1/2 inches.**
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, **7/8 inch** deep.
 4. Resilient Furring Channels: **1/2-inch-** deep members designed to reduce sound transmission.
- F. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
 - b. Chicago Metallic Corporation.
 - c. USG Interiors, Inc.; Drywall Suspension System.

2.3 STEEL PARTITION AND SOFFIT FRAMING

- A. Components, General: As follows:
 1. Comply with ASTM C 754 for conditions indicated.

2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with manufacturer's standard corrosion-resistant zinc coating.
- B. Steel Studs and Runners: ASTM C 645.
 1. Minimum Base Metal Thickness: As indicated 25 ga.
 2. Depth: As indicated **3-5/8 inches**, unless otherwise noted.
 - C. Deep-Leg Deflection Track: ASTM C 645 top runner with **2-inch-** deep flanges.
 - D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - E. Cold-Rolled Channel Bridging: **0.0538-inch** bare steel thickness, with minimum **1/2-inch-** wide flange.
 1. Depth: **1-1/2 inches**.
 - F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - G. Resilient Furring Channels: **1/2-inch-** deep, steel sheet members designed to reduce sound transmission.
 - H. Cold-Rolled Furring Channels: **0.0538-inch** bare steel thickness, with minimum **1/2-inch-** wide flange.
 - I. Z-Shaped Furring: With slotted or nonslotted web, face flange of **1-1/4 inches**, wall attachment flange of **7/8 inch**, minimum bare metal thickness of **0.0179 inch**, and depth required to fit insulation thickness indicated.
 - J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

2.4 INTERIOR GYPSUM WALLBOARD

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Gypsum Wallboard: ASTM C 36.
 1. Type X:
 - a. Thickness: **5/8 inch**, unless otherwise indicated.
 - b. Long Edges: Tapered.
 - c. Location: As indicated.
 2. Moisture-resistant type:
 - a. Thickness: **5/8 inch**, unless otherwise indicated.
- C. Sag-Resistant Gypsum Wallboard: ASTM C 36, manufactured to have more sag resistance than regular-type gypsum board.
 1. Thickness: **1/2 inch**.
 2. Long Edges: Tapered.
 3. Location: Ceiling surfaces.

2.5 TILE BACKING PANELS

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Water-Resistant Gypsum Backing Board: ASTM C 630/C 630M.
 - 1. Core: **5/8 inch**, Type X.
- C. Cementitious Backer Units: ANSI A118.9.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Wonderboard.
 - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
 - c. United States Gypsum Co.; DUROCK Cement Board.
 - d. National Gypsum Co.; Wonderboard.
 - 3. Thickness: **5/8 inch**.
- D. Locations:
 - 1. All tile substrate.

2.6 EXTERIOR GYPSUM BOARD SHEATHING

- A. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- B. Water resistant Gypsum Backing Board: ASTM C79
 - 1. GP DensGlas Gold
 - 2. Core: ½ inch
 - 3. Fire Rated: 5/8 inch

2.7 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, or rolled zinc.
 - 2. Shapes:
 - a. Cornerbead: Use at outside corners.
 - b. LC-Bead (J-Bead): Use at exposed panel edges.
 - c. L-Bead: Use where indicated.
 - d. U-Bead: Use where indicated.
 - e. “VEE” shaped at vertical and horizontal control joint locations, unless noted otherwise

2.8 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475.
- B. Joint Tape:
 - 1. Interior Gypsum Wallboard: Paper.
 - 2. Tile Backing Panels: As recommended by panel manufacturer.

- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
- D. Joint Compound for Tile Backing Panels:
 - 1. Cementitious Backer Units: As recommended by manufacturer.

2.9 ACOUSTICAL SEALANT

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
 - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
 - C. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant complying with ASTM C 834 that effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

2.10 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from **0.033 to 0.112 inch** thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

2.11 TEXTURE FINISHES

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- B. Products: Subject to compliance with requirements, provide the following:
 - 1. Refer to Finish Schedule.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement.
- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
 - 3. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
 - 4. Secure hangers to structure, including intermediate framing members, by attaching to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 6. Do not attach hangers to steel deck tabs.
 - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within **1/8 inch in 12 feet** measured lengthwise on each member and transversely between parallel members.

- C. Sway-brace suspended steel framing with hangers used for support.
- D. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.
- E. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
 - 1. Hangers: **48 inches** o.c.
 - 2. Carrying Channels (Main Runners): **48 inches** o.c.
 - 3. Furring Channels (Furring Members): **16 inches** o.c.
- F. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
 - 1. Where studs are installed directly against exterior walls, install asphalt-felt or foam-gasket isolation strip between studs and wall.
- B. Installation Tolerance: Install each steel framing and furring member so fastening surfaces vary not more than **1/8 inch** from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural deck or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
 - 1. Cut studs **1/2 inch** short of full height to provide perimeter relief.
 - 2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
- D. Install steel studs and furring at the following spacings:
 - 1. Single-Layer Construction: **16 inches** o.c., unless otherwise indicated.
 - 2. Multilayer Construction: **16 inches** o.c., unless otherwise indicated.
 - 3. Cementitious Backer Units: **16 inches** o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
- F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - 1. Install two studs at each jamb, unless otherwise indicated.

2. Install cripple studs at head adjacent to each jamb stud, with a minimum **1/2-inch** clearance from jamb stud to allow for installation of control joint.
 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above.
- G. Frame openings other than door openings the same as required for door openings, unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
- H. Provide screw attachment of both stud faces to track.

3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216.
- B. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum panels with face side out. Butt panels together for a light contact at edges and ends with not more than **1/16 inch** of open space between panels. Do not force into place.
- E. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Form control and expansion joints with space between edges of adjoining gypsum panels.
- I. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than **8 sq. ft.** in area.
 2. Fit gypsum panels around ducts, pipes, and conduits.
 3. Where partitions intersect open concrete coffer, concrete joists, and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by coffer, joists, and other structural members; allow **1/4- to 3/8-inch-** wide joints to install sealant.
- J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide **1/4- to 1/2-inch-** wide spaces at these locations, and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- K. STC-Rated Assemblies: Seal construction at perimeters, behind control and expansion joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and manufacturer's written recommendations for locating edge trim and closing

off sound-flanking paths around or through gypsum board assemblies, including sealing partitions above acoustical ceilings.

- L. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
 - 1. Space screws a maximum of **12 inches** o.c. for vertical applications.
- M. Space fasteners in panels that are tile substrates a maximum of **8 inches** o.c.
- N. Install water-resistant gypsum board as follows, including but not limited to:
 - 1. All wet areas.
 - 2. Restrooms.
 - 3. All tile areas.
 - 4. Janitor(s).

3.7 PANEL APPLICATION METHODS

- A. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
 - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Tile Backing Panels:
 - 1. Cementitious Backer Units: ANSI A108.11, at showers, tubs, and where indicated.
 - 2. Areas Not Subject to Wetting: Install standard gypsum wallboard panels to produce a flat surface except at showers, tubs, and other locations indicated to receive water-resistant panels.
 - 3. Where tile backing panels abut other types of panels in the same plane, shim surfaces to produce a uniform plane across panel surfaces.

3.8 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

3.9 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
 - 1. Level 4: Embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges at panel surfaces that will be exposed to view, unless otherwise indicated.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.10 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.

END OF SECTION 09260

SECTION 09511 - ACOUSTICAL PANEL CEILINGS**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.

1.2 SUBMITTALS

- A. Product Data: For each type of product specified.
- B. Samples for Verification: Sample for each color, texture, and pattern specified, showing the full range of variations expected in these characteristics.
 - 1. ~~6-inch~~- square samples of each acoustical panel type, pattern, and color.
 - 2. Set of ~~12-inch~~- long samples of exposed suspension system members, including moldings, for each color and system type required.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced installer who has completed acoustical panel ceilings similar in material, design, and extent to that indicated for this Project.
- B. Source Limitations for Ceiling and Suspension Units: Obtain from one source with resources to provide products of consistent quality in appearance and physical properties without delaying the Work. Obtain both acoustical ceiling panels and suspension system from the same manufacturer.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels and suspension system in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.6 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size units equal to 2.0 percent of amount installed.
 - 2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of amount installed.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: As scheduled.
 - 1. Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264.

2.2 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable ASTM C 635 requirements.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, Direct Hung) will be less than yield stress of wire, but provide not less than **0.106-inch**- diameter wire.
 - 3. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Comply with paint manufacturer's written instructions for applying and baking and for minimum dry film thickness.
 - a. Organic Coating: Manufacturer's standard thermosetting coating system with a minimum dry film thickness of **0.8 to 1.2 mils**.
 - b. Color: As selected by Architect from manufacturer's standard colors.
 - c. Color: Match color indicated by referencing manufacturers' standard color designations.
 - 4. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong World Industries, Inc.
 - b. Celotex Corporation (The); Building Products Division; Architectural Ceilings Marketing Dept.
 - c. USG Interiors, Inc.
- D. Hold-Down Clips for Non-Fire-Resistance-Rated Ceilings: For interior ceilings consisting of acoustical panels weighing less than **1 lb/sq. ft.**, provide hold-down clips spaced **24 inches** o.c. on all cross tees.

2.3 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following requirements:

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage, and other conditions affecting performance of acoustical panel ceilings.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with publications referenced below per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
 - 1. Standard for Ceiling Suspension System Installations: Comply with ASTM C 636.
 - 2. CISCA's Recommendations for Acoustical Ceilings: Comply with CISCA's "Recommendations for Direct-Hung Acoustical Tile and Lay-in Panel Ceilings--Seismic Zones 0-2."
 - 3. U.B.C.'s "Metal Suspension Systems for Acoustical Tile and for Lay-in Panel Ceilings": U.B.C. Standard 25-2.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
 - 5. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 6. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both structure to which hangers are attached and type of hanger involved.

- Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
7. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
 8. Do not attach hangers to steel deck tabs.
 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 10. Space hangers not more than **48 inches** o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than **8 inches** from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than **16 inches** o.c. and not more than **3 inches** from ends, leveling with ceiling suspension system to a tolerance of **1/8 inch in 12 feet**. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to long axis of space.
 - c. Install panels with pattern running in one direction parallel to short axis of space.
 - d. Install panels in a basket-weave pattern.
 2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 3. For reveal-edged panels on suspension system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension system surfaces and panel faces flush with bottom face of runners.
 4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.
 5. Protect lighting fixtures and air ducts to comply with requirements indicated for fire-resistance-rated assembly.

3.4 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09511

SECTION 09650 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the installation of vinyl or rubber base and resilient stair treads with sheet rubber flooring on landings.

1.2 RELATED WORK

A. Color and texture: SCHEDULE FOR FINISHES.

1.3 SUBMITTALS

A. Submit in accordance with Section 01330, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

- 1. Description of each product.
- 2. Base and stair material manufacturer's recommendations for adhesives.
- 3. Application and installation instructions.

C. Samples:

- 1. Base: 6 inches long, each type and color.
- 2. Resilient Stair Treads: 6 inches long.
- 3. Sheet Rubber Flooring: 12 inches square.
- 4. Adhesive: Literature indicating each type.

1.4 DELIVERY

- A. Deliver materials to the site in original sealed packages or containers, clearly marked with the manufacturer's name or brand, type and color, production run number and date of manufacture.
- B. Materials from containers which have been distorted, damaged or opened prior to installation will be rejected.

1.5 STORAGE

- A. Store materials in weather tight and dry storage facility.
- B. Protect material from damage by handling and construction operations before, during, and after installation.

1.6 APPLICABLE PUBLICATIONS

- A. The publication listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
F1344-10.....Rubber Floor Tile

F1859-10.....Rubber Sheet Floor Covering without Backing

F1860-10.....Rubber Sheet Floor Covering with Backing

F1861-08.....Resilient Wall Base

C. Federal Specifications (Fed. Spec.):

RR-T-650E.....Treads, Metallic and Non-Metallic, Nonskid

PART 2 - PRODUCTS

2.1 GENERAL

Use only products by the same manufacturer and from the same production run.

2.2 RESILIENT BASE

- A. ASTM F1861, 3 mm (1/8 inch) thick, 100 mm (4 inches) high, Thermoplastics, Group 2-layered. Style B-cove.
- B. Where carpet occurs, use Style A-straight.
- C. Use only one type of base throughout.

2.3 RESILIENT TREADS

- A. Fed. Spec. RR-T-650, Composition A, Type 2, 5 mm (3/16 inch) thick on wear surface tapering to 3 mm (1/8 inch) thick at riser end.
- B. Nosing shape to conform to sub-tread nosing shape.

2.4 SHEET RUBBER FLOORING

- A. ASTM F1344, F1859 or F1860, 900 mm (36 inches) wide, 3 mm (1/8 inch) thick, smooth face, material by the same manufacturer as the rubber treads, color and pattern to match treads.
- B. Use for stair landings.
- C. Use rubber flooring made with a minimum of 90% consumer rubber where possible.

2.5 PRIMER (FOR CONCRETE FLOORS)

As recommended by the adhesive and tile manufacturer.

2.6 LEVELING COMPOUND (FOR CONCRETE FLOORS)

Provide products with latex or polyvinyl acetate resins in the mix.

2.7 ADHESIVES

- A. Use products recommended by the material manufacturer for the conditions of use.
- B. Use low-VOC adhesive during installation. Water based adhesive with low VOC is preferred over solvent based adhesive.

PART 3 - EXECUTION

3.1 PROJECT CONDITIONS

- A. Maintain temperature of materials above 21° C (70 °F), for 48 hours before installation.

- B. Maintain temperature of rooms where work occurs, between 21° C and 27° C (70°F and 80°F) for at least 48 hours, before, during, and after installation.
- C. Do not install materials until building is permanently enclosed and wet construction is complete, dry, and cured.

3.2 INSTALLATION REQUIREMENTS

- A. The respective manufacturer's instructions for application and installation will be considered for use when approved by the Resident Engineer.
- B. Submit proposed installation deviation from this specification to the Resident Engineer indicating the differences in the method of installation.
- C. The Resident Engineer reserves the right to have test portions of material installation removed to check for non-uniform adhesion and spotty adhesive coverage.

3.3 PREPARATION

- A. Examine surfaces on which material is to be installed.
- B. Fill cracks, pits, and dents with leveling compound.
- C. Level to 3 mm (1/8 inch) maximum variations.
- D. Do not use adhesive for leveling or filling.
- E. Grind, sand, or cut away protrusions; grind high spots.
- F. Clean substrate area of oil, grease, dust, paint, and deleterious substances.
- G. Substrate area dry and cured. Perform manufacturer's recommended bond and moisture test.
- H. Preparation of existing installation:
 - 1. Remove existing base and stair treads including adhesive.
 - 2. Do not use solvents to remove adhesives.
 - 3. Prepare substrate as specified.

3.4 BASE INSTALLATION

- A. Location:
 - 1. Unless otherwise specified or shown, where base is scheduled, install base over toe space of base of casework, lockers, laboratory, pharmacy furniture island cabinets and where other equipment occurs.
 - 2. Extend base scheduled for room into adjacent closet, alcoves, and around columns.
- B. Application:
 - 1. Apply adhesive uniformly with no bare spots.
 - 2. Set base with joints aligned and butted to touch for entire height.
 - 3. Before starting installation, layout base material to provide the minimum number of joints with no strip less than 600 mm (24 inches) length.

- a. Short pieces to save material will not be permitted.
 - b. Locate joints as remote from corners as the material lengths or the wall configuration will permit.
- C. Form corners and end stops as follows:
1. Score back of outside corner.
 2. Score face of inside corner and notch cove.
- D. Roll base for complete adhesion.

3.5 STAIR TREAD INSTALLATION

- A. Prepare surfaces to receive the treads in accordance with applicable portions of paragraph, preparation.
- B. Layout of Treads.
1. No joints will be accepted in treads.,
 2. Set full treads on intermediate and floor landings.
- C. Application:
1. Apply adhesive uniformly with no bare spots.
 2. Roll and pound treads to assure adhesion.

3.6 SHEET RUBBER INSTALLATION.

- A. Prepare surfaces to receive sheet rubber in accordance with applicable portions of paragraph, preparation.
- B. Layout of Sheet Rubber:
1. Use minimum number of joints compatible with material direction and symmetrical joint location.
 2. Where sheet rubber intersect vertical stair members, other sheets, stair treads, and other resilient materials at the floor landings, material shall touch for the entire length within 5 mils (0.005 inch).
 3. Install sheet rubber on floors and intermediate landings where resilient stair treads are installed; center joint with other flooring material under doors.
- C. Application:
1. Apply adhesive uniformly with no bare spots.
 2. Roll sheet rubber to assure adhesion.

3.7 CLEANING AND PROTECTION

- A. Clean all exposed surfaces of base and adjoining areas of adhesive spatter before it sets.
- B. Keep traffic off resilient material for at least 72 hours after installation.

- C. Clean and polish materials in the following order:
 - 1. After two weeks, scrub resilient base, sheet rubber and treads materials with a minimum amount of water and a mild detergent. Leave surfaces clean and free of detergent residue. Polish resilient base to a gloss finish.
 - 2. Do not polish tread and sheet rubber materials.
- D. When construction traffic is anticipated, cover tread materials with reinforced kraft paper and plywood or hardboard properly secured and maintained until removal is directed by the Resident Engineer.
- E. Where protective materials are removed and immediately prior to acceptance, replace damaged materials and re-clean resilient materials. Damaged materials are defined as having cuts, gouges, scrapes or tears and not fully adhered.

- - - E N D - - -

SECTION 09666 - CONCRETE FLOOR SEALER**PART 1. GENERAL**

1.01 SUMMARY

- A. Penetrating Sealers / water repellents

1.02 SUBMITTALS

- A. Submit Endur-O-Seal USA, Inc. product data and application instructions

1.03 QUALITY ASSURANCE & CONTROL

- A. Applicator/Commercial: Company specializing in applying coatings, waterproofing/repellents with five (5) years minimum experience and approved by manufacturer required. Consult local distributor or Endur-O-Seal USA,/EOS Systems for recommendations.

1.04 FIELD SAMPLES

- A. Field samples should be applied prior to general execution of work to determine visual and physical or chemical effect of sealer. Prepare substrates and apply Poly Top Seal CSx-2O to a 100 square foot area. Apply to locations indicated by architect/designer/engineer. Notify architect/ designer/engineer seven (7) days prior to application of field sample.
- B. Test area samples may remain as part of general work.
- C. Sample shall indicate that there is no change appearance and when water is poured on the sample, the water shall bead or run off and not soak in.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site with containers unopened and with manufacturer's seal intact.

1.06 PROJECT CONDITIONS

- A. Environmental Requirements: Do not apply Poly Top Seal CSx-2O when the following conditions are present, except with written instructions from manufacturer:
- B. Ambient or surface temperature less than 40° F within twenty four (24) hours prior to or following application.
- C. Rain within seventy- two (72) hours prior to application or predicted within twenty- four (24) hours after application.
- D. Wet or frozen substrates
- E. High winds which could cause excessive over spray.

1.07 SCHEDULING

- A. Apply Poly Top Seal CSx-2O as early as practical to protect substrates during construction. Do not apply to walls until wall cap is finalized.
- B. Allow joint mortar to cure seven (7) days before treatment. (Based on 70° F & 60% relative humidity)

1.08 WARRANTY

- A. Manufacturer's limited five (5) year warranty. Failure is indicated by water soaking into the substrate surface, when water is placed on surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

Endur-O-Seal USA, Inc./ EOS Systems, 1-800-259-8855 or 281-356-9332 fax.

2.02 MATERIALS

- A. Poly Top Seal CSx-2O: Water based membrane-forming polysiloxane penetrating sealer; this system is non-flammable, non-hazardous and non-toxic.
1. Maximum VOC content; 0.27 lbs/gallon, complies with all applicable regulations regarding VOC's.
 2. Do not dilute or modify Poly Top Seal CSx-2O, apply as supplied.

2.03 EQUIPMENT

- A. Spray Equipment: 60 psi or below airless, and/or Hudson pump up type. Tip should be fan pattern and of the size (Hudson 80-5R Color Jet) or smaller. Keep equipment and hoses clean and free of foreign contaminants that could obstruct equipment or be deposited on surfaces to be treated.

Note! Do not over saturate!

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Confirm that the substrates have been prepared properly, and weather conditions are suitable for application. Notify architect/designer/engineer in writing of unsatisfactory substrates and conditions. Do not continue until conditions have been corrected in a manner acceptable to applicator.

3.02 PREPARATION

- A. Clean substrates: Remove dirt, oil, wax, curing compounds, efflorescence, coatings and other graffiti matter. Use methods compatible with substrates and required appearance including, as applicable.
1. Sweeping and compressed air blasting
 2. Water blasting
 3. Sandblasting, follow with an air and/or water blast to remove loose particulate.
 4. Detergent scrubbing. Rinse with water and allow to dry.
 5. Chemical cleaners that are residual free and do not interfere with penetrating sealer/repellent. Rinse with water and allow substrate to dry.

If you have questions or concerns, consult Endur-O-Seal USA, Inc at 1-800-259-8855 or FAX 281-356-9332 for information or recommendations.

Always protect glass and non-porous materials. Poly Top Seal CSx-2O will not harm plants, asphalt, glass, metal or aluminum. Some plastics, such as polystyrene, will be damaged by EOS Poly Top Sealer. Poly Top Seal CSx-2O is compatible with most joint sealants, specific joint sealants should be investigated for adhesion to treated surfaces. Contact Endur-O-Seal USA, Inc for assistance. 1-800-259-8855

- a. Protect against over spray onto glass surfaces, plants, plastic, asphaltic surfaces, painted and polystyrene insulation surfaces.
- b. Protect surfaces against oil/grease/fuel drips caused by cleaning equipment and other contamination of surfaces that are to be tested.

B. JOINT SEALANTS

1. If necessary, install joint sealants as specified in other sections and allow to cure before application of water repellent.
2. If joint sealants are installed after application of Poly Top Seal CSx-2O, verify adhesion of joint sealant to treated surfaces, prior to execution of work. If required, protect joint sealant adhesion surfaces against over spray.

3. Install asphaltic joint sealant after application of EOS Poly Top Sealer.

3.03 APPLICATION

A. General:

1. Properly clean and dry area to be treated, if unsure as to the best procedure, contact Endur-O-Seal or substrate manufacturer.
2. The temperature of the substrate should be 40°F – 120°F (4.4 C - 49° C)
3. The area to be treated should have relative moisture content of less than 15%.
4. The Poly Top Seal CSx-2O should be thoroughly stirred/ mixed prior to application.
5. Apply a thorough wetting coat in accordance with rates specified below, but Do Over Not Saturate.
6. If applying by spray, motion should be side to side and followed by a crosshatch up and down motion.
7. On horizontal applications, remove any excess after fifteen (15) minutes from initial application (use clean mop or cotton cloth).
8. *Treated areas should be kept moisture free for 8-12 hours after application.*
9. *****Always test a sample are prior to application***.**

- #### B. If work is stopped prior to completion, clearly mark location and resume work without any gap in coverage.

C. COVERAGE:

1. Vertical Surfaces:

- Precast: 250 (minimum)/ 400 (maximum) sq. ft./Gal.
Poured-in-place: 350 (minimum)/ 450 (maximum) sq. ft./Gal.
CMU (smooth): 250 (Minimum)/ 300 (maximum) sq. ft./Gal.
CMU (Split face): 200 (Minimum)/ 275 (maximum) sq. ft./Gal.
(some split face block may require several applications)

2. Horizontal Surfaces:

- Poured in-place: 300 (minimum)/ 400 (maximum) sq. ft./Gal.
Compressed paver: 100 (minimum)/ 200 (maximum) sq. ft./Gal.

3.04 CLEANING

- #### A. Clean overspray on glass or metallic surfaces before evaporation of water. Wipe dry with clean, dry-cloth. If material has cured use a 50/50 mix of denatured alcohol and water and rub with a clean cloth.

3.05 PROTECTION

- #### A. Do not permit traffic on treated surfaces until Poly Top Seal CSx-2O has completely penetrated and the substrate is fully dry.
- #### B. Treated areas should be kept moisture free for 8-12 hrs after application.
- #### C. Always utilize proper industrial hygiene practices. Adequate ventilation should be provided during application and observe manufacturer's safety instructions. Read MSDS and labels before using.

END OF SECTION

SECTION 09900 - PAINTING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes surface preparation and field painting of the following:
 - 1. Exposed exterior items and surfaces.
 - 2. Exposed interior items and surfaces.
 - 3. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect or Interiors Consultant will select from standard colors and finishes available.
 - 1. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.
- C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
 - 1. Finished metal surfaces include the following:
 - a. Anodized aluminum.
 - b. Stainless steel.
 - 2. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

1.3 SUBMITTALS

- A. Product Data: For each paint system indicated, including fillers and primers.
- B. Samples for Verification: Of each color and material to be applied.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.
- B. Benchmark Samples (Mockups): Provide a full-coat benchmark finish sample of each type of coating and substrate required on the Project.
 - 1. Final approval of colors will be from job-applied samples.

2. Mockups: 4'x4'

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
 1. Product name or title of material.
 2. Product description (generic classification or binder type).
 3. Manufacturer's stock number and date of manufacture.
 4. Contents by volume, for pigment and vehicle constituents.
 5. Thinning instructions.
 6. Application instructions.
 7. Color name and number.
 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.6 PROJECT CONDITIONS

- A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

- A. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.
 1. Quantity: Furnish the Owner with an additional 5 percent, but not less than 1 gallon of each material and color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products in the paint schedules.

- B. **Manufacturers Names:** The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:
1. Devoe & Raynolds Co. (Devoe).
 2. Benjamin Moore & Co. (Moore).
 3. Sherwin-Williams Co. (S-W).
 4. ICI
 5. Pittsburgh Paints

2.2 PAINT MATERIALS, GENERAL

- A. **Material Compatibility:** Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. **Material Quality:** Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
1. **Proprietary Names:** Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.
- C. **Colors:** Provide color selections made by the Architect and/or Interiors Consultant

2.3 INTUMESCENT PAINT – FOR FIRE RATED WALLS IF AND WHERE NOTED IN PLANS.

- a. Fire Guard E-84 by Shield Industries 800-332-6327 or equal

PART 3 - EXECUTION

3.1 EXAMINATION

- A. **Examine substrates, areas, and conditions,** with the Applicator present, under which painting will be performed for compliance with paint application requirements.
1. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
 2. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.
- B. **Coordination of Work:** Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
1. Notify the Architect about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

- A. **General:** Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

- B. Cleaning: Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Cementitious Materials: Prepare concrete, concrete masonry block, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
 - a. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces where moisture content exceeds that permitted in manufacturer's written instructions.
 - b. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
 - 2. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
 - 3. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.
 - 4. Galvanized Surfaces: Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
- D. Materials Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
 - 1. Paint colors, surface treatments, and finishes are indicated in the schedules.
 - 2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.
 - 3. Provide finish coats that are compatible with primers used.
 - 4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.
 - 5. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.

7. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.
 8. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.
 9. Finish interior of wall and base cabinets and similar field-finished casework to match exterior.
 10. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.
1. Apply no less than one coat primer and two finish coats.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.
- F. Electrical items to be painted include, but are not limited to, the following:
1. Conduit and fittings.
 2. Switchgear.
 3. Panelboards.
 4. Phoneboards.
- G. Prime Coats: Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.
- H. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

3.6 EXTERIOR PAINT SCHEDULE

- B. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
 - 1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
 - a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.
 - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils.
- A. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
 - 1. Low-Luster Finish: 2 finish coats over a galvanized metal primer.
 - a. Primer: Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - b. First and Second Coat: Low-luster (eggshell or satin), exterior, acrylic-latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.8 mils.

3.7 INTERIOR PAINT SCHEDULE

- A. Woodwork and Hardboard: Provide the following paint finish systems over new, interior wood surfaces:
 - 1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a wood undercoater.
 - a. Undercoat: Alkyd- or acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
- B. Ferrous Metal: Provide the following finish systems over ferrous metal:
 - 1. Semigloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoater and a primer.
 - a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils.
 - b. Undercoat: Alkyd, interior enamel undercoat or semigloss, acrylic-latex, interior enamel, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mi.
 - c. Finish Coat: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils.

3.8 INTUMESCENT PAINT:

END OF SECTION 09900

SECTION 10155 - TOILET COMPARTMENTS**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.

1.2 SUMMARY

- A. This Section includes toilet compartments and screens as follows:
 - 1. Type: HDPE – High Density Polyethylene
 - 2. Compartment Style: Overhead braced and floor anchored.
 - 3. Screen Style: Wall hung.

1.3 SUBMITTALS

- A. Product Data: For each type and style of toilet compartment and screen specified.
- B. Shop Drawings: For fabrication and installation of toilet compartment and screen assemblies. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: Manufacturer's full range of textures, and patterns available for each type of compartment or screen indicated.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Accurate Partitions Corporation.
 - 2. Ampco Products, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Knickerbocker Partition Corporation.
 - 5. Santana Products, Inc.

2.2 MATERIALS

- A. General: Provide materials that have been selected for surface flatness and smoothness. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are unacceptable.
- B. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, that is leveled to stretcher-leveled flatness, finished on exposed faces as indicated in the "Stainless-Steel Sheet Finishes" Article.

- C. Core Material for Metal-Faced Units: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch minimum for doors, panels, and screens and 1-1/4 inches minimum for pilasters.
- D. Pilaster Shoes and Sleeves (Caps): ASTM A 666, Type 302 or 304 stainless steel, not less than 0.0312 inch thick and 3 inches high, finished to match hardware.
- E. Full-Height (Continuous) Brackets: Manufacturer's standard design for attaching panels and screens to walls and pilasters of the following material:
 - 1. Material: Stainless steel.
- F. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of the following material:
 - 1. Material: Chrome-plated, nonferrous, cast zinc alloy (zamac) or clear-anodized aluminum.
- G. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile in manufacturer's standard finish.
- H. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel or chrome-plated steel or brass, finished to match hardware, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use hot-dip galvanized or other rust-resistant, protective-coated steel.

2.3 FABRICATION

- A. General: Provide standard doors, panels, screens, and pilasters fabricated for compartment system. Provide units with cutouts and drilled holes to receive compartment-mounted hardware, accessories, and grab bars, as indicated.
 - 1. Provide internal reinforcement in metal units for compartment-mounted hardware, accessories, and grab bars, as indicated.
- B. Metal-Faced Toilet Compartments and Screens: Pressure laminate seamless face sheets to core material and provide continuous, interlocking molding strip or lapped and formed edges. Seal corners by welding or clips. Grind exposed welds smooth.
- C. Overhead-Braced-and-Floor-Anchored Compartments: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, fasteners, and anchors at pilasters to suit floor conditions. Make provisions for setting and securing continuous head rail at top of each pilaster. Provide shoes at pilasters to conceal supports and leveling mechanism.
- D. Wall-Hung Screens: Provide units in sizes indicated of same construction and finish as compartment panels.
- E. Doors: Unless otherwise indicated, provide 24-inch- wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch- wide clear opening for compartments indicated to be handicapped accessible.
 - 1. Hinges: Manufacturer's standard self-closing type that can be adjusted to hold door open at any angle up to 90 degrees.
 - 2. Latch and Keeper: Manufacturer's standard surface-mounted latch unit with combination rubber-faced door strike and keeper designed for emergency access. Provide Paddle style handle unit at accessible stall, that comply with accessibility requirements of authorities having jurisdiction.
 - 3. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent door from hitting compartment-mounted accessories.

4. Door Bumper: Manufacturer's standard rubber-tipped bumpers at out-swinging doors or entrance screen doors.
5. Door Pull: Manufacturer's standard unit that complies with accessibility requirements of authorities having jurisdiction at out-swinging doors. Provide units on both sides of doors at compartments indicated to be handicapped accessible.
6. Handle: Paddle style handle at accessible stall.

2.4 STAINLESS-STEEL SHEET FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations relative to applying and designating finishes.
 1. Remove or blend tool and die marks and stretch lines into finish.
 2. Grind and polish surfaces to produce uniform, directional textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- B. Finish: Manufacturer's standard No. 3 or No. 4 directional polish.
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, plumb, and level. Provide clearances of not more than 1/2 inch between pilasters and panels and not more than 1 inch between panels and walls. Secure units in position with manufacturer's recommended anchoring devices.
- B. Overhead-Braced-and-Floor-Anchored Compartments: Secure pilasters to floor and level, plumb, and tighten. Secure continuous head rail to each pilaster with not less than 2 fasteners. Hang doors and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
 1. Caulk top and bottom joints of pilaster shoes.
- C. Screens: Attach with anchoring devices according to manufacturer's written instructions and to suit supporting structure. Set units level and plumb and to resist lateral impact.

3.2 ADJUSTING AND CLEANING

- A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and swing doors in entrance screens to return to fully closed position.
- B. Provide final protection and maintain conditions that ensure toilet compartments and screens are without damage or deterioration.

END OF SECTION 10155

SECTION 10425 - SIGNS**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.

1.2 SUMMARY

- A. This Section includes the following types of signs:
 - 1. Panel signs.

1.3 SUBMITTALS

- A. Product data for each type of sign specified, including details of construction relative to materials, dimensions of individual components, profiles, and finishes.
- B. Samples: Provide the following samples of each sign component for initial selection of color, pattern and surface texture as required and for verification of compliance with requirements indicated.
 - 1. Samples for initial selection of color, pattern, and texture:
 - a. Aluminum: smooth and textured.

1.4 QUALITY ASSURANCE

- A. Design Concept: The Drawings indicate sizes, profiles, and dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aluminum: as selected from the manufacturer's standards.
- B. Fasteners: Use concealed fasteners fabricated from metals that are not corrosive to the sign material and mounting surface.
- C. Anchors and Inserts: Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

2.2 SIGNS

- A. Fabricate signs with edges mechanically and smoothly finished to conform with the following requirements:
 - 1. Edge Condition: Beveled.

2. Corner Condition: Corners rounded to radius indicated.
- B. Graphic Content and Style: Provide sign copy that complies with the requirements indicated for size, style, spacing, content, position, material, finishes, and colors of letters, numbers, and other graphic devices.
- C. Engraved Copy: Machine-engage letters, numbers, symbols, and other graphic devices into sign panel on the face indicated to produce precisely formed copy, incised to uniform depth.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Locate sign units and accessories where indicated, using mounting methods of the type described and in compliance with the manufacturer's instructions.
 1. Install signs level, plumb, and at the height indicated, with sign surfaces free from distortion or other defects in appearance. Comply with ADA requirements.
- B. Signs: Concealed mounting.

END OF SECTION 10425

SECTION 10750- FLAGPOLES**PART 1 GENERAL**

1.1 SECTION INCLUDES

- A. Ground-Set Flagpoles.
- B. Accessories.

1.2 REFERENCES

- A. ASTM B 241/B 241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements:
 - 1. Flagpole height: 30 feet.
 - 2. Flag sizes:
 - a. National: 5' feet by 8 feet.
 - b. State: 5'feet by 8 feet.
- B. Performance Requirements:
 - 1. Flagpole with flag flying: Resistant to ____ miles per hour wind velocity without permanent deformation.
 - 2. Flagpole without flag: Resistant to ____ miles per hour wind velocity without permanent deformation.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: Manufacturer's descriptive literature for flagpoles, including all components.
- C. Shop Drawings: Indicate locations and types of flagpoles in project; indicate mounting details.
- D. Selection Samples: Two sets of color chips representing manufacturer's full range of available colors.
- E. Verification Samples: Two samples, minimum size 6 inches square, representing actual color and finish of installed product.
- F. Quality Assurance Submittals:
 - 1. Design Data: Documentation of compliance to specified performance requirements, bearing seal and signature of registered Professional Structural Engineer licensed to practice in the State in which the project is located.
 - 2. Manufacturer's printed installation instructions for indicated project conditions.
- G. Closeout Submittals:
 - 1. Project record documents:
 - 2. Operation and maintenance data for specified flagpoles.

3. Warranty documents: Issued and executed by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

1.6 SCHEDULING

- A. Ensure that anchoring devices are supplied to installers requiring them in time for building-in to substrates.

1.7 WARRANTY

- A. Manufacturer's Warranty: Furnish flagpole manufacturer's standard warranty against defects in product workmanship and materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Concord Industries, Inc., which is located at: 4150 Kellway Cir. P. O. Box 2449; Addison, TX 75001-2449; Toll Free Tel: 800-527-3902; Tel: 972-380-8186; Fax: 800-426-5770; Email: scott@concordindustries.com; Web: www.concordindustries.com OR EQUAL
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00.
- C. Substitutions: Not permitted.

2.2 GROUND SET FLAGPOLES

- A. Acceptable Product: Concord Continental Ground Set Flagpole. OR EQUAL
- B. Shaft:
 1. Material: Seamless cone-tapered aluminum tubing conforming to ASTM B 241, Alloy 6063, Temper T6.
 2. Finish: Natural; polished to deep luster sheen.
 3. Finish: Polished to deep luster sheen; clear anodized finish conforming to AA M32-C22-A41.
 4. Finish: Polished to deep luster sheen; color anodized finish conforming to AA M32-C12-A42.
 5. Finish: Powder coated.
 6. Color: Dark bronze, Number 313.
- C. Truck: Cast aluminum housing and spindle, with one 2-3/8 inches diameter cast nylon sheaves; revolving mounting with 26 stainless steel ball bearings, non-fouling.
- D. Halyard: One per flagpole as follows:
 1. Material: 5/16 inch (8 mm) diameter (Number 10) white waterproof polypropylene.
 2. Hardware: Two chrome swivel-type flag snaps each set, spaced for specified flag sizes.
- E. Cleat: One (1) cast aluminum cleat per flagpole, 9 inches long, finish matching

shaft, with stainless steel socket-head anchor bolts.

2.3 GROUND SET FLAGPOLES

- A. Acceptable Product: Concord Independence Concealed Halyard System.
- B. Shaft:
 - 1. Material: Seamless cone-tapered aluminum tubing conforming to ASTM B 241, Alloy 6063, Temper T6.
 - 2. Finish: Natural; polished to deep luster sheen.
 - 3. Finish: Polished to deep luster sheen; clear anodized finish conforming to AA M32-C22-A41.
 - 4. Finish: Polished to deep luster sheen; color anodized finish conforming to AA M32-C12-A42.
 - 5. Finish: Powder coated.
 - 6. Color: Dark bronze, Number 313.
- C. Truck: Cast aluminum housing and spindle, internal halyard type, with 2-1/2 inches diameter plated sheave; revolving mounting, non-fouling.
- D. Truck: Cast aluminum, stationary.
- E. Halyard:
 - 1. Material: 1/8 inch diameter braided steel aircraft wire.
 - 2. Hardware: Two chrome swivel-type flag snaps each set, spaced for specified flag sizes; stainless steel quick links attached to halyard ends, with connecting swivel; neoprene-coated counterweight, beaded nylon retainer ring.
- F. Winch and Handle: Internal direct-drive, gearless type mounted on rotating plate; winch constructed of stainless steel, locking in any position upon removal of winch handle; single reinforced access opening and door with keylock, with access hole in door for winch handle.
- G. Cleat: Internal-mounted at factory, cam-action with internal sheave; cast aluminum access door and frame with keylock.

2.4 ACCESSORIES

- A. Ground Sleeve: Galvanized steel components as follows:
 - 1. Foundation tube: Corrugated, 16 gage, diameter and length specified in manufacturer's descriptive literature for indicated flagpole height; centered on, and welded to face of base plate.
 - 2. Base plate: Square, side dimensions 4 inches greater than inside dimension of foundation tube.
 - 3. Ground spike: 3/4 inch diameter, 18 inches long; centered on, and welded to face of base plate opposite foundation tube attachment.
 - 4. Setting plate: 6 inches square, with drilled hole at center for attachment to ground spike; welded perpendicular to length of ground spike 6 inches from base plate.
- B. Shoebase Mounting Hardware:
 - 1. Anchor base: Cast aluminum, heat-treated, drilled for anchor bolt diameter and pattern specified in manufacturer's descriptive literature for indicated flagpole height; sleeved over shaft butt and joined to shaft butt by continuous circumferential welds at outside top and inside bottom of base; entire assembly, including flagpole, heat-treated after attachment of shoebase

- casting.
2. Fasteners: Quantity, diameter, and length specified in Manufacturer's descriptive literature for indicated flagpole height; include anchor bolts, nuts and washers.
- C. Flash collar: Manufacturer's standard spun aluminum flash collar, finish matching shaft; size specified in manufacturer's descriptive literature for indicated flagpole height.
 - D. Finial: Spun aluminum, 14 gage wall thickness, flush seam, gold anodized finish, diameter matching butt diameter of shaft.
 - E. Cleat Covers: Aluminum housing, finish matching shaft, with key-operated cylinder lock, keyed alike for multiple units; two keys supplied for each lock.
 - F. Halyard Boxes: Aluminum housing, finish matching shaft, 5 feet in length.

2.5 MIXES

- A. Concrete: 3000 pounds per square inch compressive strength at 28 days; 6 percent air entrainment.
- B. Grout: Non-shrink; 5000 pounds per square inch compressive strength at 28 days.

2.6 FABRICATION

- A. Provide self-aligning internal sleeves for shafts fabricated in sections for field assembly; field-welded connections, including plug-welding, are not permitted.
- B. Fabricate end-to-end joints of shaft sections for hairline joint after connection; match mark and number shaft sections for field assembly.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Anchoring devices are correct type, and in correct location, in accordance with approved shop drawings and manufacturer's instructions.
- B. Installer's Examination:
 1. Have installer of this section examine conditions under which construction activities of this section are to be performed, then submit written notification if such conditions are unacceptable.
 2. Transmit two copies of installer's report to Architect within 24 hours of receipt.
 3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.
 4. Beginning construction activities of this section indicates installer's acceptance of conditions.

3.2 INSTALLATION

- A. Install flagpole components and accessories in accordance with approved shop drawings and manufacturer's installation instructions.
- B. Ground Sleeve:
 1. Excavate in undisturbed soil to indicated depth, width, and length, providing shoring for unstable soil conditions; remove non-soil materials from

- excavation.
2. Coat surface of ground sleeve assembly, and surfaces of shaft that will be installed below grade, with bituminous paint, minimum 5 mil dry film thickness (DFT).
 3. Place ground sleeve assembly in excavation, locating as indicated; drive ground spike into undisturbed soil to extent that base plate is flush with bottom of excavation.
 4. Place concrete in excavation immediately after mixing, using chute to deliver concrete to placement; surround ground sleeve with concrete, placing concrete to finish grade, and compacting with vibrators.
 5. Slope concrete surface from top of ground sleeve to grade for water run-off to grade; screed concrete surface to smooth trowel finish.
 6. Moist-cure concrete surface; allow concrete to attain full 28-day compressive strength before installing flagpole.
- C. Shoe Base:
1. Set base in grout bed of sufficient height that excess grout is displaced as anchoring and adjusting of flagpole progresses; align base hole pattern with anchor bolts and lower base to grout bed.
 2. Anchor and align flagpole plumb; provide temporary bracing until grout attains full compressive strength.
 3. Screed sight-exposed grout surfaces to 45-degree fillet, removing excess grout from substrate.

END OF SECTION

SECTION 10801 - TOILET AND BATH ACCESSORIES**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.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Toilet and bath accessories.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions and thicknesses, dimensions, profiles, fastening and mounting methods, specified options, and finishes for each type of accessory specified.
- B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required. Use designations indicated in the Toilet and Bath Accessory Schedule and room designations indicated on Drawings in product schedule.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Provide products of same manufacturer for each type of accessory unit and for units exposed to view in same areas, unless otherwise approved by Architect.

1.5 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering accessories that may be incorporated into the Work include:
 - 1. A & J Washroom Specialties.
 - 2. American Specialties, Inc.
 - 3. Bobrick Washroom Equipment, Inc.
 - 4. Bradley Corporation.

2.2 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, with No. 4 finish (satin), in 0.0312-inch minimum nominal thickness, unless otherwise indicated.
- B. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit, tamper and theft resistant when exposed, and of galvanized steel when concealed.

2.3 FABRICATION

- A. General: One, maximum 1-1/2-inch- diameter, unobtrusive stamped manufacturer logo, as approved by Architect, is permitted on exposed face of accessories. On interior surface not exposed to view or back surface of each accessory, provide printed, waterproof label or stamped nameplate indicating manufacturer's name and product model number.
- B. Surface-Mounted Toilet Accessories: Unless otherwise indicated, fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with continuous stainless-steel hinge. Provide concealed anchorage where possible.
- C. Recessed Toilet Accessories: Unless otherwise indicated, fabricate units of all-welded construction, without mitered corners. Hang doors and access panels with full-length, stainless-steel hinge. Provide anchorage that is fully concealed when unit is closed.
- D. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

2.4 PRODUCTS

- A. Provide products as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with applicable TDLR installation requirements.
- B. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- C. Install grab bars to withstand a downward load of at least 250 lbf when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 10801

SECTION 13340 – METAL BUILDING SYSTEMS**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Metal Building System as indicated on the drawings and specified herein.
- B. Include components and parts of the building consisting of primary structural steel framing, purlins, girts, necessary bracing, struts and connecting members, gutters and downspouts, canopies and necessary closures and fasteners.
- C. Section 07210 Insulation

1.2 GENERAL REQUIREMENTS

- A. Cooperation and coordination with other trades is mandatory, so that each phase of work will be properly coordinated without delays or damage to any parts of any work.

1.3 RELATED SECTIONS

- A. Structural Drawings – Cast-In-Place Concrete: Foundations and anchor bolts.
- B. Section 055000 - Metal Fabrications
- C. Section 081100 - Metal Doors and Frames
- D. Section 083600 – Sectional Overhead Doors
- E. Section 099000 - Painting

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA,
 - 1. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified Professional Engineer licensed to practice in the state having jurisdiction.
- B. Erector Qualifications: An experienced erector who specializes in erecting and installing work similar in material, design, and extent to that indicated for this project and who is acceptable to the manufacturer.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, “Structural Welding Code – Steel.”
 - 2. AWS D1.3, “Structural Welding Code – Sheet Steel.”
- D. Structural Steel: Comply with AISC 360, “Specification for Structural Steel Buildings,” for design requirements and allowable stresses.
- E. Cold-Formed Steel: Comply with AISI’s “North American Specification for the Design of Cold-Formed Steel Structural Members” for design requirements and allowable stresses.

1.5 DEFINITIONS

- A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.6 BUILDING NOMENCLATURE

- A. The building "Width" and "Length" shall be measured from inside to inside face of wall covering.
- B. The building "Eave Height" shall be measured from main building finish floor elevation to the intersection of lines representing the inside of the wall covering and the inside of the roof covering.
- C. The "Roof Slope" shall be as indicated on the drawings.
- D. The "Bay Spacing" between frame center lines shall be as shown on drawings.
- E. The "Wind Bracing" locations shall be as indicated

1.7 DESIGN AND LOADS

- A. Structural steel sections and welded plate members shall be designed in accordance with the latest edition of AISC, "Specifications for Design, Fabrication, and erection of Steel for Buildings" previous to the year of the building code as indicated on the drawings.
- B. Cold formed structural members and exterior covering shall be designed in accordance with the AISI, "Specification for the Design of Cold-Formed Steel Structural Members".
- C. Design Loads shall be in accordance with IBC or ASCE 7. The relevant year of the code shall be as indicated on the drawings. Loads shall include:
 - 1. Basic design loads, as well as collateral loads shall be as specified.
 - a. Basic design loads in addition to dead load; include live load, wind load, snow load, and seismic load.
 - b. Collateral loads include dead loads over and above weight of the metal building system, such as mechanical systems, ceiling systems, and sprinklers. Insulation weight is considered part of the metal building system. Collateral loads shall be as specified in the drawings.
 - c. Design each member to withstand stresses resulting from combinations of loads that produce maximum stresses in that member. Load combinations shall be based on ASCE 7.
 - 2. Roof Live Load: (20) PSF basic live load, reducible per the building code specified on the drawings.
 - 3. Dead Load: Withstand weight of metal building system as determined by actual weight of all roofing materials.
 - 4. Collateral Load: As specified on the drawings.
 - 5. Thermal Load: Withstand movement caused by ambient temperature range of 100 degrees F and surface temperature range of 120 degrees F.
 - 6. Special Loads: Concentrated Loads less than 250 pounds need not be considered in the design of the structure. Investigate structure for all loadings above 250 pounds and provide support beams where purlins or joists cannot support the load.

- a. Concentrated loads on purlins shall be hung from the purlin web. Connections shall be screwed or bolted, bolts shall be set in drilled holes; torch cutting of bolt holes shall not be allowed. Field welding to the purlins shall not be allowed unless approved by the metal building system manufacturer. Attachments to the purlin bottom flange shall not be allowed unless specifically approved by the metal building system manufacturer. Reference MBMA Manual section A6 Hanging Loads on Purlins.
7. Wind Load: For design of primary members, secondary members, and cladding, calculate wind pressures in accordance with ASCE 7. Use wind speed, exposure, and importance factor as indicated on the drawings. Wind pressures for deflection calculations shall be based on recurrence interval called for in the building code indicated on the drawings.
8. Seismic Load: Design primary and bracing members for seismic loads in accordance with ASCE 7. Use importance factor, spectral response accelerations, and soil site class as indicated on the drawings. In the absence of listed spectral accelerations, determine in accordance with USGS. In the absence of a listed site class, assume site class D.
9. Crane Loads: Not necessary for this project.
10. Drift and Deflection Criteria: As indicated on drawings.

1.8 ROOF PANEL SYSTEM PERFORMANCE

- A. Panel system shall have a UL 2218, Class 4 Impact Resistance Rating.
- B. Metal roof system must be tested in accordance with UL Test Method 580, Tests for Uplift Resistance of Roof Assemblies. UL Class 90 uplift rating.
- C. Resist the roof design pressures calculated in accordance with ASCE 7 for the year as indicated on the drawings. Determine panel bending and clip-to-clip strength by testing in accordance with ASTM E1592. Capacity for gauge, span or loading other than those tested may be determined by interpolating test results.
- D. Metal roof system must meet the air infiltration requirements of ASTM E1680 when tested with a 6.24 PSF pressure differential with resulting air infiltration of 0.0071 cfm/sq. ft.
- E. Metal roof system must meet the water penetration requirements of ASTM E1646 when tested with a 12.00 PSF pressure differential with no uncontrollable water leakage when five (5) gallons per hour of water is sprayed per square foot of roof area.

1.9 SUBMITTALS

- A. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a qualified Professional Engineer licensed to practice in the state having jurisdiction.
- B. Certification: Letter of Design Certification: Signed and Sealed by a qualified Professional Engineer licensed to practice in the state having jurisdiction. Include the following:
 1. Name and location of project.
 2. Order Number
 3. Name of Manufacturer
 4. Name of Contractor
 5. Building dimensions including width, length, height, and roof slope

6. Indicate compliance with AISC standards for hot-rolled and plate steel and NAUS standards for cold-rolled steel, including editions of each standard.
 7. Governing building code and year of edition
 8. Design Loads: Include dead load, roof live load, floor live loads, collateral loads, roof snow load, deflection criteria, wind loads/speeds and exposure, seismic design category, importance factors, and any auxiliary loads (i.e. cranes)
- C. Shop Drawings: Show building layout, primary and secondary framing member sizes and locations, cross-sections, and product and connection details.
1. Show Roof, fascia, gutter, downspouts, siding and soffit panel layout and connection details.
 2. Show Stair plans, sections and details where applicable.
- D. Product Data: Information on manufactured products to be incorporated into the project.
- E. Color Charts: For selection of colors.
- F. Anchor Bolt Installation Drawings: Layouts with bolt diameters.
- G. Anchor Bolt Setting Templates: To assist with setting of anchor bolts.

1.10 WARRANTY

- A. Warrant the work specified herein against becoming unserviceable or causing an objectionable appearance resulting from either defective or non-conforming materials or workmanship. Warranty shall be a "Weather tightness" Warranty. Field Reports are required throughout Project and are to be supplied by a Manufacturer's Approved Technical Inspector.
1. Roof Panels and Finish: Section 07400 – Preformed Metal Roofing
 2. Weathertightness (optional, only applies to standing seam roofs):
 - a. The roof system including roof panels, flashings, curbs, interior gutters, etc. shall be warranted by the manufacturer against leaks for a period of 20 years.
 - b. The warranty shall be issued to the Owner by the Manufacturer at time of Project Substantial Completion.
 - c. The warranty shall guarantee the entire roof system and associated work against defective materials and workmanship of installation.
 - d. The roof system shall include roof insulation, flashing, metal work, labor, and material shall be guaranteed against failure of workmanship and materials. Repair of the system by the manufacturer, including materials and labor, shall be done at no cost to the Owner.
 - e. Curbs shall be approved by roofing manufacturer.
 3. Roofing Contractor: Jointly with any subcontractors employed by him, shall guarantee the work required and performed under this contract will be free from defects in workmanship and materials, and that the building will be and remain waterproof for a five (5) year warranty period, after the Architect accepts the work as substantially complete. The warranty shall be in approved notarized written form, to obligate the Contractor, and subcontractors, to make good the requirements of the warranty.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Specifications are based on products listed below as “Basis of Specification”, except where specified otherwise. Manufacturers named below whose product meets or exceeds the specifications are approved for use on the Project. Other manufacturers must have a minimum of five (5) years experience manufacturing products meeting or exceeding the specifications and comply with Division 1 requirements regarding substitutions to be considered.
1. Metal Building System:
 - a. Red Dot Building Systems, Athens, TX (800) 657-2234
 - b. Alliance Steel, Oklahoma City, OK (800) 624-1579
 - c. Mueller Inc. Ballinger, TX; (800) 527-1087 United Structures of America, Houston, TX; (281) 442-8247
 - d. Horizon Structural Systems, New Braunfels, TX; (830) 629-8000
 - e. Architect approved equal.
 2. Metal Roof, Wall, and Roof Liner Panels:
 - a. MBCI, Houston, TX; (281) 847-8044 (Basis of Specification)
 - b. Architect approved equal from Metal Building Manufacturer

2.2 METAL MATERIALS

- A. Select materials and material yield strengths based on building design requirements; use the following unless required otherwise.
1. Structural Steel Plate, Bar, Sheet, and Strip for Use in Bolted and Welded Constructions: ASTM A572, A570, A529, or A36, with minimum yield strength of 50,000 psi.
 2. Structural Steel Material for Use in Roll Formed or Press Broken Secondary Structural Members: ASTM A570, or A607 with minimum yield strength of 55,000 psi.
 3. Galvanized Steel Sheet for Roll Formed or Press Broken Roof and Wall Coverings, Trim and Flashing: ASTM A653, with minimum yield strength of 50,000 psi.
 4. Galvalume Steel Sheet Used in Roll Formed or Press Broken Roof Covering: Aluminum-zinc alloy-coated steel sheet, ASTM A792, with minimum yield strength of 50,000 psi; nominal coating weight of 0.5 oz. per sq. ft. both sides, equivalent to an approximate coating thickness of 0.0018 inch both sides.
 5. Hot Rolled Steel Shapes: W, M and S shapes, angles, rods, channels and other shapes; ASTM A572, or ASTM A3 as applicable; with minimum yield strengths required for the design.
 6. Structural Bolts and Nuts Used with Primary Framing: High strength, ASTM A325.
 7. Bolts and Nuts Used with Secondary Framing Members: ASTM A307.
 8. Anchor Bolts: ASTM A307 or A325.
- B. Finish:
1. Primary and secondary Structural Members: if no finish is noted on drawings, use manufacturer's standard GREY rust-inhibitive primer paint in manufacturer's standard color.
 - a. If drawings call for galvanized primary or secondary members: hot-dip galvanize, G-60.
 2. Prefinished Materials: Thermoset Silicone Polyester Coating System (25 year warranty) as selected by Architect from manufacturer's full line.

2.3 FRAMING COMPONENTS

- A. Primary Framing: Rigid Frame (RF Series) solid web framing consisting of tapered depth rafters rigidly connected to tapered depth columns. Provide interior column spacing's as indicated on drawings.
- B. Endwall Framing: Corner posts, endposts and rake beams.
- C. Purlins: Zee-shaped; depth as required; with minimum yield strength of 55,000 psi; simple span or continuous span as required for design.
- D. Girts: Zee- or Cee-shaped; depth as required, with minimum yield strength of 55,000 psi; simple span or continuous span as required for design.
- E. Transbay Members: Open web, parallel chord, secondary joists; simple span, utilizing materials, sizes and yield strength as required.
- F. Wind Bracing: Portal, torsional, diagonal bracing or diaphragm in accordance with manufacturer's standard design practices; utilizing rods, angles, and other members, with minimum yield strengths as required for design.
- G. Primary Frame Flange Bracing: Attached from purlins or girts to the primary framing, minimum yield strength as required for design.
- H. Base Angles: 2 inch by 4 inch by 0.059 inch steel angles, with minimum yield strength of 55,000 psi, anchored to the floor slab or grade beam with power driven fasteners or equivalent at a maximum spacing of 2 feet on center and not more than six (6) inches from the end of any angle member.
- I. Sag Strapping and Bridging: 22 gauge strapping and/or steel angles, with minimum yield strength of 36,000 psi. as required by design.
- J. Fabrication: Fabricate according to manufacturer's standard practice.
 - 1. Fabricate structural members made of welded plate sections by jointing the flanges and webs by continuous automatic submerged arc welding process.
 - 2. All welding operators and processes shall be qualified in accordance with AWS D1.1.
 - 3. Field connections. Prepare members for bolted field connections by making punched, drilled, or reamed holes in the shop.
- K. Component Identification: Mark all fabricated parts, either individually or by lot or group, using an identification marking corresponding to the marking shown on the shop drawings, using a method that remains visible after shop painting.
- L. Shop Coating: Finish enclosed structural steel members using one (1) coat of manufacturer's standard shop coat, after cleaning of oil, dirt, loose scale and foreign matter.
- M. Anchor Bolts: Hooked or Headed anchor bolts in quantities and spacing's as required by the metal building system design. Anchor bolts to be provided by metal building manufacturer.

2.4 ROOF AND WALL PANEL COMPONENTS

- A. Metal Roof Panels: MBCI PBR Panel
 - 1. Panel Profile: 36" wide x 1-1/4" inch high, with 12" on center rib spacing.
 - 2. Panel attachment: exposed fastening system.

3. Gauge: Minimum 26 gauge (UL 90 rated)
 4. Finish: Signature 300 (Kynar 500) – color to be selected
 5. Ridge Vent: Manufacturer's standard to match roof panel in color and finish
- B. Gutters, downspouts, fascias, soffits, and flashings:
 1. All exposed gutters, downspouts, fascias, soffits and flashings shall be provided by roof panel manufacturer and shall match roof panel finish and color. Soffit to be MBCI FlexLoc system.
- C. Metal Wall Panels: MBCI PBC Panel
 1. Panel Profile: 32" wide x 7/8" inch high, with 2.67" on center rib spacing.
 2. Panel attachment: exposed fastening system.
 3. Gauge: Minimum 26 gauge (UL 90 rated).
 4. Finish: Prefinished per ASTM 792-86 with Thermoset Silicone Polyester Coating System (25 year warranty) in color selected by Architect from manufacturer's available colors.
- D. Interior Metal Liner Panel (Where indicated on plans): MCBI IL-240-0 24" x 1 1/2", 24 GA.
- E. Panel Fasteners: Carbon steel zinc-aluminum hex head complete with integrated metal and neoprene sealing washer. Color of exposed fastener heads to match the panel finish. Fastener type shall not void warranty of panel finish.
 1. "Long Life" fasteners for attachment of roof panels to secondary framing members, attachment to adjoining panels, and attachment of trim to the panels: Self-drilling type, of size required by the manufacturer.
 2. Standard fasteners for attachment of wall panels to secondary framing members, attachment to adjoining panels, and attachment of trim to the panels: Self-drilling type, of size required by the manufacturer.
 3. Provide fasteners in quantities and location as required by the manufacturer.
 4. Fasteners for trim splices: 1/8 inch by 3/16 inch stainless steel blind rivet. Head shall be color coated to match trim colors.
- F. Flashing and Trim: Match material and color of adjacent components. Provide trim at rakes, including peak and corner assemblies, high and low eaves, corners, bases, framed openings and as required or specified to provide weathertightness and a finished appearance.
- G. Sealants, Mastics and Closures: Manufacturer's standard type.
 1. Provide at roof panel endlaps, sidelaps, rake, eave, transitions and accessories as required to provide a weather resistant roof system; use tape mastic or gunnable sealant at sidelaps and endlaps.
 2. Provide at wall panel rakes, eaves, transitions and accessories.
 3. Closures: Formed to match panel profiles; closed cell elastic material, manufacturer's standard color.
 4. Tape Mastic: Pre-formed butyl rubber-based, non-hardening, non-corrosive to metal; white or light gray.

5. Gunnable Sealant: Non-skinning synthetic elastomer based material; gray or bronze.

2.5 ROOF ACCESSORIES

- A. Eave Gutters: Press-broke 26 gauge steel sheet in 20 foot or longest practical length, with gutter straps, fasteners and joint sealant. Gutter shall screen the eave ends of roof sheets from view. Color shall be as selected by Architect from manufacturer's full line.
- B. Downspouts: Shall be 26 gauge steel sheet in 10 foot or longest practical length, rectangular shaped. Downspouts shall be supported by attachment to the wall covering at 10 feet maximum spacing to 4" above grade. Color shall be as selected by Architect from manufacturer's full line.

2.6 INSULATION SYSTEM – REFER TO SECTION 072100 INSULATION

- A. Insulation:
 1. Fiberglass shall be as outlined in the North American Insulation Manufacturers Association (NAIMA 202-96) and ASTM C 991-03 Type 1, or equal with an R-value AS INDICATED when not compressed.
 2. The fiberglass shall be Polypropylene-Scrim-Kraft faced blankets.
 3. The composite of fiberglass and facing shall have surface burning characteristics not to exceed 25 flame spread and 50 smoke developed when tested in accordance with ASTM E 84 or Underwriters Laboratories 723 test method.
- B. Facing:
 1. Facing shall be composed of Polypropylene/ Scrim/ Core/ Metalized Polyester.
 2. The resulting facing shall have:
 - a. A water vapor transmission rate of .02 US Perm (ASTM E 96 Procedure A)
 - b. A mullen burst of 120 psi.
 3. Tensile strength shall be:
 - a. 65 lbs in the machine direction.
 - b. 60 lbs in the cross-machine direction.
 4. Vinyl Color white – refer to architectural plans
 5. Installation:
 - a. To be draped over purlins.
 - b. Should be in lengths that will cover the distance from eave to eave plus an extra 12" on each end to overhang each side of the building.
 - i. If more than one roll is required to span the roof, a ridge pan will be utilized.
 - c. The width of the first run of insulation to be 1'-0" wider than the width of the roofing panel. Succeeding runs to be either the same width or twice the width of the roof panels.
 - d. Tab fastening to utilize two (2) 3" tabs

6. Approved Manufacturers:
 - a. Bay Insulation of South Texas
 - b. PBI Supply
 - c. Therm-All

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Assist in placement of anchor bolts using robotic total station device. Verify that anchor bolts are installed as indicated on anchor bolt shop drawings.
- B. Following erection, PEMB manufacturer shall inspect (and reinspect following corrective work, as needed) the building and provide engineer with documentation that the building has been erected in accordance with the construction documents and PEMB manufacturer's recommendations.

3.2 ERECTION

- A. Provide temporary bracing, shoring, blocking, bridging and securing of components as required during the erection process.
- B. Erection must be performed by an erector acceptable to the metal building system manufacturer.
- C. Erect building system in accordance manufacturer's instructions, erection drawings, and other erection documents.
- D. Install roof panels, wall panels, and roof liner panels straight and true, free from defects in accordance manufacturer's instructions.
- E. Paint burns, scars, welds, and damaged and rusted surfaces with cold galvanizing paint in accordance with ASTM A780.
- F. Isolate dissimilar metal contact with proper taping and/or coatings.
- G. Install flashings and accessories to provide a watertight system.
- H. Cut and install insulation at in accordance with manufacturer's printed instructions and sealed to ensure continuity of building envelope, whether indicated or not.
- I. Provide accessories recommended by manufacturer for a complete installation.

END OF SECTION 033400

SECTION 15010 - GENERAL MECHANICAL PROVISIONS**PART 1 - GENERAL****1.1 WORK INCLUDED IN THIS SECTION**

- A. Referenced Documents: Bidding Requirements, Conditions of the Contract and Division 1 - General Requirements are hereby made a part of this section.
- B. Work included in Division 15 includes furnishing of all labor, materials, tools, equipment, drayage, rigging, fees, permits, inspections, etc. necessary for complete installation and operation of all mechanical equipment and work as shown on the drawings and/or specified herein.
- C. Wherever the term "Mechanical Subcontractor" appears in this Division of the Specifications, to be construed as referring both individually and collectively to both the plumbing and air conditioning/heating contractors.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Division 1.
- B. Paintings: Division 9.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- 1. Local Building, Mechanical, and Plumbing Codes.
- 2. Requirements of Gas, Sewer, and Water Utilities Departments.
- 3. Air-Conditioning and Refrigeration Institute (ARI).
- 4. Air Movement and Control Association (AMCA).
- 5. American National Standards Institute (ANSI).
- 6. American Society for Testing and Materials (ASTM).
- 7. American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE Guides).
- 8. American Society of Mechanical Engineers (ASME).
- 9. American Welding Society (AWS).
- 10. International Energy Conservation Code (IECC).
- 11. National Fire Protection Association Standards (NFPA).
- 12. Occupational Safety and Health Administration (OSHA).
- 13. Sheet Metal and Air-Conditioning Contractors National Association, Inc. (SMACNA), (Duct Manual and Sheet Metal Construction).
- 14. Underwriters' Laboratories, Inc. (UL).

1.4 QUALIFICATIONS

- A. Mechanical Subcontractor of Work specified herein to have been engaged in mechanical contracting business for a minimum of five (5) years to bid date and be prepared to show evidence and references if required by Owner.

1.5 SUBSTITUTIONS AND DEVIATIONS

- A. The intent of these specifications is to establish minimum quality standards for material and equipment installed. All materials, equipment, and apparatus shall be new and of the quality indicated in the following specifications.
- B. It is not the Architect/Engineer's intention to discriminate against any manufacturer or product. Any manufacturer desiring to submit his product for approval as an equal to that specified may do so by providing a sample specification to the Engineer's office for approval a minimum of 10 working days prior to bid date. Also, the manufacturer must have local factory-trained service personnel and be able to provide back-up service to contractors upon request.

1.6 SUBMITTALS

- A. Shop drawings and brochures shall be submitted as specified in the following sections, and as required by the Architect and/or Owner.

1.7 PERMITS AND FEES

- A. Procure all necessary and usual permits and certificates for all work installed.
- B. Deliver to Owner before final acceptance.
- C. Pay all inspection fees necessary.
- D. Pay all charges for connection.
- E. Coordinate with local utilities for the furnishing of all water meters, complete with meter box, cover, and backflow preventer, gas meters and pressure regulators. Subcontractor will arrange for and pay all costs and deposits.

1.8 SPECIAL CONDITIONS OF WORK

- A. Drawings accompanying these plans are necessarily diagrammatic and cannot show every detail or every line of piping in its exact location. These are subject to the requirements of ordinances, structural and architectural conditions.
- B. Investigate structural and finish conditions and arrange work accordingly; furnish all fittings and accessories required to meet conditions and give satisfactory operation. Coordinate with other Subcontractors to avoid interference with their work. Work shall be laid out to be concealed in furred chases, suspended ceilings, etc., in finished portions of building, unless specifically noted to be exposed. Work to be installed to avoid crippling of structural members. The Mechanical Subcontractor, by submitting a bid, sets forth that he has the necessary

technical training and ability and that he will install his work in a satisfactory and workmanlike manner up to the best standard of the trade, complete and in good working order. If any of the requirements of the Plans and Specifications are impossible to perform, or if the installation will not perform satisfactorily, he shall report same to the Owner for correction during the bidding period. No extra will be allowed for extra work or changes caused by failure to comply with above requirements. The right to make any reasonable change in the location of outlets, apparatus, and equipment up to time of rough-in is reserved by the Owner without involving any additional expense to the Owner.

1.9 SITE INVESTIGATION

- A. Mechanical Subcontractor is to visit the site and ascertain conditions to be met there in installing his work and make due provision for same in his bid.
- B. It will be assumed that the Mechanical Subcontractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install his work. Failure to comply with this requirement shall not be considered justification for omission or faulty installation of any of his work, or for payment of extra compensation for work covered by specifications and plans.
- C. Locations and elevation of utilities shown on plans have been obtained from site utility plans and existing plans. Subcontractor shall examine site verifying to his own satisfaction location and elevation of all utilities, and shall adequately inform himself as to their relation to his work before entering into a contract.
- D. Specifications and Drawings in no way imply as to condition of soil to be encountered. When excavating may be required in execution of work, Mechanical Subcontractor agrees that he has informed himself regarding conditions affecting work, labor and materials required, without recourse to any representation as to soil conditions that may appear, or seem to be implied in any portion of Contract Documents.

1.10 SAFETY STANDARDS

- A. It shall be the responsibility of the Mechanical Subcontractor initiating, maintaining and supervising all safety precautions required by local, state and federal laws, including OSHA (Occupational Health and Safety Administration).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials described in Division 15 to be new; no used materials to be used.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. Work shall be done in accordance with plans and specifications and shall meet rules and regulations of all governing agencies having jurisdiction.
- B. If plans and specifications differ from required minimum standards set forth in ordinances, ordinances shall govern unless plans and specifications exceed requirements in which case plans and specifications shall govern.

3.2 LOCAL BOARDS

- A. Before submitting a bid, Mechanical Subcontractor shall familiarize himself with the rules of all governing boards having jurisdiction, and he shall notify the Owner before submitting his bid, if in his opinion, any work or material specified is contrary to such rules.
- B. The Mechanical Contractor shall not sublet any part of this work unless approved by the Owner, who shall also approve of the subcontractor. Approvals will not relieve the Mechanical Subcontractor of full responsibility.

3.3 GUARANTEE

- A. Work to be guaranteed for a period of one (1) year from date of acceptance by Owner.
- B. Upon notice of any mechanical malfunction, the Mechanical Subcontractor to remedy malfunction including all materials, equipment and labor at no extra cost to Owner.

3.4 OPENING AND RECLOSING PAVEMENTS AND LAWNS

- A. Where excavation requires the opening of existing walks, streets, drives, other existing pavement, or lawns, such surfaces shall be cut as required to install new lines and to make new connections to existing lines. The sizes of the cut shall be held to a minimum, consistent with the work to be accomplished. After the installation of the new work is completed and the excavation has been backfilled and flooded, the areas shall be patched, using materials to match those cut out. The patches shall thoroughly bond with the original surfaces and shall be level with them, and shall meet all the requirements established by the authorities having jurisdiction over such areas.

3.5 SLEEVES

- A. Where concealed pipes pass through partitions, walls and floors, provide galvanized steel pipe sleeves of sizes to readily accommodate pipe, or pipe plus insulation.
- B. For vertical pipes and conduit through concrete beams, provide sleeves of Schedule 40 galvanized steel pipe.
 - 1. Plumbing risers in chases, or exposed, to also have galvanized steel pipe sleeves which extend 1 1/2" above floor.

- C. Pipe projecting through roofing to be made watertight by proper flashing, a sheet metal cap and tightening band.
 - 1. Flashings to be furnished by Mechanical Subcontractor and installed by roofer.
 - 2. Plumbing vent lines to have sheet lead flashings of 4 pound lead extending a minimum of 15 inches in all directions from pipe and turned down into top of pipe minimum of 1 inch.

3.6 FLOOR AND CEILING PLATES

- A. Except as otherwise noted, provide and install chrome plated sectional floor and ceiling plates around pipe passing exposed through walls, floors and ceilings.
- B. Solid plates with set screws to be used on any lines where the sectional plates will not stay in place or are not available in adequate size.

3.7 INTERIOR CUTTING AND PATCHING

- A. Should any structural difficulties prevent installation of fixtures, equipment, running of pipes, etc., at all points shown on drawings, then necessary minor deviations therefrom, as determined by Owner, may be permitted and must be made without additional cost to Owner.
- B. Any necessary cutting into partitions, walls, floors to be neatly and carefully done. No cutting into structural parts of building, likely to impair strength of building, to be done without approval of Owner.
- C. Mechanical Subcontractor to be held responsible for all damage caused by his work or through the neglect of his workmen. All patching and repairing of damaged work to be done under direction of Owner at expense of Mechanical Contractor.

3.8 SCAFFOLDING

- A. Furnish and erect, at Subcontractor's expense and risk, any and all appliances, scaffolding, lights, guards, temporary walls, tools, transportation, etc., required for the proper construction or protection of this work.

3.9 CONTRACTOR'S COORDINATION AND CLEANING UP

- A. Subcontractor shall cooperate with the other Subcontractors on the job and shall carry on his work in such a manner that none of the other Subcontractors shall be handicapped, hindered, or delayed. When work is finished, remove from the premises all tools, machines, debris, etc., occasioned by his work, and leave the premises free of all obstructions and hindrances. This shall be done in order that there will be no interference in installation, nor delay in completion of any part or parts of the work, thereby permitting all construction work to proceed in its natural sequence without unnecessary delay.
- B. Where mechanical work occurs in masonry walls, the installation shall be done sufficiently in advance of construction; fittings, appurtenances, etc., shall be installed in such a manner and at such locations as to avoid unnecessary cutting of masonry units. Work erected in advance of masonry shall be securely supported and held in position to prevent displacement. Cutting and fitting of masonry around properly located equipment will be done by masons. Place work

located in partitions or ceilings ahead of the construction, with equipment securely wired in place. The Subcontractor shall have a representative on the job during all concrete pours to insure that all of his equipment is adequately supported and protected and will not be adversely affected by such operations.

- C. Coordinate with the local utility companies in such a manner that the installation of all services proceeds in an orderly manner, and meets all requirements of the specific companies involved.

3.10 SUPERVISION

- A. All work in connection with this Contract will be under the supervision and to the entire satisfaction of the Owner or his authorized representative who shall determine all questions as to the satisfactory completion of the work, or any part thereof, and defects necessary to be remedied.
- B. The Subcontractor shall give his personal attention to all parts of the work and shall employ only skilled and reliable workmen in the performance thereof. They shall also accord the Owner the right to decide upon and discontinue the services of any workman who does not possess satisfactory skill and qualifications, or is otherwise objectionable.

3.11 PARTS LISTS AND MAINTENANCE MANUALS

- A. The Mechanical Subcontractor shall submit to the Owner thirty (30) days prior to final acceptance of the building, complete and detailed parts lists, maintenance manuals, etc., covering mechanical equipment furnished under this contract. Brochures shall include all as-built equipment shop drawings, all cuts and capacity information, names and addresses of manufacturers, stocking distributors, manufacturer's agents and/or factory representatives and shall cover all items of equipment on which submittal data is made and shall also include manuals and lists herein called for.

3.12 AS-BUILT DRAWINGS

- A. At the completion of this project, the Mechanical Subcontractor shall provide the Owner with a set of drawings showing all ductwork, equipment, piping, valves, etc., installed by the Mechanical Subcontractor. These drawings shall be complete in every detail and shall incorporate all changes made during the course of the conduct of the project. These drawings shall be prepared in such a manner as to enable the Owner to properly maintain, operate and repair both concealed and exposed work.

3.13 PAINTING AND FINISHING

- A. Refer to Division 9.

3.14 TEMPORARY WATER FAUCETS AND EQUIPMENT

- A. Mechanical Subcontractor to furnish temporary water, heating, waste, etc., equipment and connections as specified in Division 1 - General Requirements.

3.15 USE OF FIXTURES AND MATERIALS

- A. Under no circumstances shall fittings, equipment and materials installed in the building be used for any purpose prior to installation. After installation but prior to acceptance of the building, fixtures shall not be used for disposal of waste material, cleaning of paint brushes, etc. The Mechanical Subcontractor shall be held responsible for the strict enforcement of this provision. Violation of this provision shall be grounds for rejection of the item involved.

3.16 LOCATIONS OF FIXTURES AND EQUIPMENT

- A. Fixtures and equipment shall be as shown on architectural plans and elevations. Locations of fixtures or equipment not shown on architectural drawings shall be established or verified in writing or by shop drawings.

3.17 EXCAVATION, TRENCHING, AND BACKFILLING

- A. All excavation, trenching and backfilling in connection with the Mechanical System is included as part of this Division.
- B. All excavation required shall be done as part of the Bid Price regardless of any implied conditions on the Plans or in these Specifications.
- C. DO NOT carry excavation below required level. Excess excavation below required level shall be backfilled at no expense to the Owner with earth, sand, gravel or concrete, as directed by Owner and thoroughly tamped. Remove unstable soil and replace with gravel, crushed stone, or clean sand and thoroughly tamp. Owner will determine depth of removal of unstable soil. Grade ground adjacent to excavations to prevent water from running-in. Remove, by pumping or other means approved by Owner, any water accumulated in excavation.
- D. Banks of trenches shall be vertical or as shown on the Drawings. Width of trench to be five-inch (5") minimum, eight-inch (8") maximum on each side of pipe bell. Bottom of trench for sewers shall be rounded so that an arc of circumference equal to 0.6 of outside diameter of pipe rests on undisturbed soil wherever practicable. Excavate bell holes accurately to size by hand. In rock, excavations shall be carried eight inches (8") below bottom of pipe. Use loose earth or gravel for backfill and tamp thoroughly.
- E. Bracing, sheathing and shoring shall be performed as necessary to complete and protect excavations indicated on the Drawings, as required for safety, as directed by Owner, or to conform to governing laws.
- F. After piping, conduit, ducts, etc. have been installed, inspected, tested and approved by Owner, backfill trenches with clean, stable soil free from large stones. Place backfill in layers, tamped under and around pipe and conduit to height of at least two feet (2') above pipe. Tamping shall be done in such manner as not to disturb underlying work. Remainder of trenches and excavations shall be backfilled with clean, stable earth, deposited in layers and brought up to rough grade, with each layer compacted to density of surrounding soil. Remove sheathing and shoring as backfill is placed and fill space with dry sand.
- G. Replace existing appurtenances removed or damaged in connection with work. Restore to original conditions, unless otherwise directed.

3.18 CLEANING UP

- A. After the equipment has been set and ready for use and before the Subcontractor leaves the job, he shall thoroughly clean all items furnished and set by him, removing all plaster, stickers, rust stains and other foreign matter, leaving every part in an acceptable condition and ready for use, as accepted by the Owner.

3.19 STARTERS

- A. Starters shall be supplied and installed by the Electrical Contractor. Coordinate sizes, locations, etc.

END OF SECTION 15010

SECTION 15055 – MECHANICAL IDENTIFICATION**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-15 Basic Materials and Methods section, and is a part of each Division-15 section making reference to identification devices specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of mechanical identification work required by this section is indicated on drawings and/or specified in other Division-15 sections.
- B. Type of identification devices specified in this section include the following:
 - 1. Plastic Pipe Markers
 - 2. Plastic Tape
 - 3. Underground-Type Plastic Line Marker
 - 4. Engraved Plastic-Laminate Signs
 - 5. Plasticized Tags
- C. Mechanical identification furnished as part of factory-fabricated equipment is specified as part of the equipment assembly in other Division-15 sections.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. ANSI Standards: Comply with ANSI A13.1 for lettering size, colors, and viewing angles of identification devices.

1.4 SUBMITTALS

- A. Product Data: Submit product specifications and installation instructions for each identification material and device required.
- B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

- C. Stencils: Where stenciled markers are provided, clean and retain stencils after completion of stenciling and include used stencils in maintenance materials, along with required stock of stenciling paints and applicators.

PART 2 - PRODUCTS

2.1 MECHANICAL IDENTIFICATION MATERIALS

- A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division-15 sections. Where more than single type is specified for application, selection is Installer's option, but provide single selection for each product category.
- B. Plastic Pipe Markers
 - 1. General: Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, color-coded, plastic-sheet pipe markers, complying with ANSI A13.1.
 - 2. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
 - a. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
 - b. Adhesive lap joint in pipe marker overlap.
 - c. Laminated or bonded application of pipe marker to pipe (or insulation).
 - d. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".
 - 3. Factory Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
 - 4. Field Lettering: Comply with piping system nomenclature as specified, scheduled or shown, and abbreviate only as necessary for each application length.
 - 5. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.
- C. Plastic Tape
 - 1. General: Manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.
 - 2. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.
 - 3. Color: Comply with ANSI A13.1 except where another color selection is indicated.
- D. Underground-Type Plastic Line Marker
 - 1. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates type of service of buried pipe.
- E. Engraved Plastic-Laminate Signs
 - 1. General: Provide engraving stock melamine plastic laminate, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording

indicated, black with white core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

- a. Thickness: 1/16" except as otherwise indicated.
 - b. Thickness: 1/8" except as otherwise indicated.
 - c. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.
2. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

F. Plasticized Tags

1. General: Manufacturer's standard pre-printed or partially pre-printed accident-prevention tags, or plasticized card stock with matt finish suitable for writing, approximately 3-1/4" x 5-5/8", with brass grommets and wire fasteners, and with appropriate pre-printed wording including large-size primary wording (as examples: DANGER, CAUTION, DO NOT OPERATE).

G. Available Manufacturers

1. General: Subject to compliance with requirements, manufacturers offering mechanical identification materials which may be incorporated in the work include, but are not limited to, the following:
 - a. Brady (W.H.) Co., Signmark Div.
 - b. Seton Name Plate Corp.

2.2 LETTERING AND GRAPHICS

- A. General: Coordinate names, abbreviations, and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering, and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of mechanical systems and equipment.
- B. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

PART 3 - EXECUTION

3.1 APPLICATION AND INSTALLATION

A. General Installation Requirements

1. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finish, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

B. Piping System Identification

1. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
 - a. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot non-insulated pipes
 2. Locate pipe markers and color bands as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations
 - a. Near each valve and control device.
 - b. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - c. Near locations where pipes pass through walls or floors/ceilings, or enter non-accessible enclosures.
 - d. At access doors, manholes, and similar access points which permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
 - g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.
- C. Underground Piping Identification
1. General: During back-filling/top-soiling of each exterior underground piping system, install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker. For tile fields and similar installations, mark only edge pipe lines of field.
- D. Mechanical Equipment Identification
1. General: Install engraved plastic laminate sign on or near each major item of mechanical equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
 - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
 - b. Meters, gages, thermometers and similar units.
- E. Refer to Division-16 sections for identification requirements of electrical work; not work of this section.
- F. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 the size of principal lettering.
- G. Text of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

- H. Operational valves and similar minor equipment items located in non-occupied spaces (including machine rooms) may, at Installer's option, be identified by installation of plasticized tags in lieu of engraved plastic signs.

END OF SECTION 15055

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SECTION 15060 - HANGERS AND SUPPORTS**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.

1.2 SUMMARY

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
 - 1. Steel pipe hangers and supports.
 - 2. Trapeze pipe hangers.
 - 3. Metal framing systems.
 - 4. Fastener systems.
 - 5. Pipe positioning systems.
 - 6. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel pipe hangers and supports.
 - 2. Powder-actuated fastener systems.
 - 3. Pipe positioning systems.
- B. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code—Steel.
- B. Welding: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1, "Structural Welding Code--Steel."
 - 2. AWS D1.2, "Structural Welding Code--Aluminum."

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. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
 - 1. AAA Technology & Specialties Co., Inc.
 - 2. Bergen-Power Pipe Supports.
 - 3. B-Line Systems, Inc.; a division of Cooper Industries.
 - 4. Empire Industries, Inc.
 - 5. ERICO/Michigan Hanger Co.
 - 6. Globe Pipe Hanger Products, Inc.
 - 7. Grinnell Corp.
 - 8. GS Metals Corp.
 - 9. National Pipe Hanger Corporation.
 - 10. PHD Manufacturing, Inc.
 - 11. PHS Industries, Inc.
 - 12. Piping Technology & Products, Inc.
 - 13. Tolco Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

2.3 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

2.4 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Available Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
 2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
 3. GS Metals Corp.
 4. Power-Strut Div.; Tyco International, Ltd.
 5. Thomas & Betts Corporation.
 6. Tolco Inc.
 7. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
- a. Hilti, Inc.
 - b. ITW Ramset/Red Head.
 - c. Masterset Fastening Systems, Inc.
 - d. MKT Fastening, LLC.
 - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Available Manufacturers:
- a. B-Line Systems, Inc.; a division of Cooper Industries.
 - b. Empire Industries, Inc.
 - c. Hilti, Inc.
 - d. ITW Ramset/Red Head.
 - e. MKT Fastening, LLC.
 - f. Powers Fasteners.

2.6 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Available Manufacturers:
 - 1. C & S Mfg. Corp.
 - 2. HOLDRITE Corp.; Hubbard Enterprises.
 - 3. Samco Stamping, Inc.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, 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, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 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 padded hangers for piping that is subject to scratching.
- F. 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.

2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 .
 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 11. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 12. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
 20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- G. 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 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

- H. 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 for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F 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 piping installations.
- I. 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. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. 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.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- J. 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.

- K. 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.
 3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
 4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
 5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.
 6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
 7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
 8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:
 - a. Horizontal (MSS Type 54): Mounted horizontally.
 - b. Vertical (MSS Type 55): Mounted vertically.
 - c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. 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 above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Fastener System Installation:
1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 15 Section "Plumbing Fixtures" for plumbing fixtures.
- F. Install hangers and supports complete with necessary 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 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 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 so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
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 according to ASME B31.1 for power piping and 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 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.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood inserts.
6. Insert Material: Length at least as long as protective shield.
7. 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 smooth bearing surface.
- 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 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 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.

3.6 PAINTING

- A. Touch Up: 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 minimum dry film thickness of 2.0 mils.
- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 "Painting Sections."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15250 – MECHANICAL INSULATION**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-15 Basic Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of mechanical insulation required by this section is indicated on drawings, and by requirements of this section.
- B. Types of mechanical insulation specified in this section include the following:
 - 1. Piping System Insulation:
 - a. Domestic Water Piping Systems.
 - b. Condensate Piping.
 - c. Refrigerant Piping Systems.
 - 2. Ductwork System Insulation:
 - a. Dual Temperature Ductwork.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of mechanical insulation products, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Certainteed Corp.
 - 3. Knauf Fiber Glass GmbH
 - 4. Owens-Corning Fiberglas Corp.
 - 5. Pittsburg Corning Corp.
 - 6. Rubatex Corp.
 - 7. Schuller Corp.
- C. Installer: A firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- D. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread rating of 25 or less, and smoke-developed rating of 50 or less, as tested by ANSI/ASTM E 84 (NFPA 255) method.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, thickness, and furnished accessories for each mechanical system requiring insulation.
- B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data in maintenance manual.
- C. Samples: Submit 1'-0" long sample of each piping insulation type required, and 1'-0" x 1'-0" sample of each duct and equipment insulation type required.
- D. Certifications: Submit certifications or other data as necessary to show compliance with these specifications and governing regulations. Include proof of compliance for test of products for fire rating, corrosiveness, and compressive strength.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard ratings of products.
- B. Protect insulation against dirt, water and chemical and mechanical damage. Do not install damaged insulation; remove from project site.

PART 2 - PRODUCTS

2.1 PIPE INSULATION MATERIALS

- A. Fiberglass Pipe Insulation: ASTM C547, Type II.
- B. Fiberglass Pipe Fitting Insulation: ASTM C553, Type V.
- C. Flexible Unicellular Pipe Insulation: FS HH-I-573, Class T.
- D. Vapor Barrier Material: ASTM C 1136, paper-backed aluminum foil, except as otherwise indicated, strength and permeability rating equivalent to adjoining pipe insulation jacketing.
- E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for application indicated.
- F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

2.2 DUCTWORK INSULATION MATERIALS

- A. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type II.
- B. Flexible Unicellular Sheet Insulation: FS HH-I-573, Class S.

- C. Vapor Barrier Material for Ductwork: ASTM C 1136, Type II, paper-backed aluminum-foil, except as otherwise indicated; strength and permeability rating equivalent to factory-applied vapor barriers on adjoining ductwork insulation, where available; with following additional construction characteristics:
 - 1. High Puncture Resistance: ASTM D 781, 50 beach units (ASJ) for ducts in exposed areas.
 - 2. Moderate Puncture Resistance: ASTM D 781, 25 beach units (FSK) for ducts in concealed areas.
- D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

3.1 PIPING SYSTEM INSULATION

- A. Insulation Omitted: Omit insulation on exposed plumbing fixture runouts from faces of wall or floor to fixture; on unions, flanges, strainers, flexible connections, and expansion joints, unless noted otherwise in the 2015 International Energy Conservation Code (IECC), with 2001 Amendments.
- B. Fiber Glass Insulation, per ASHRAE 90.1 - 2000:

Fluid Design Operating Temperature Range (°F)	Pipe Size Inches	Thickness
Domestic Hot Water Systems*		
	Runouts	0.5"
	1 and less	1.0"
105 and up (K value .24-.28 @ 100°F)	1-1/4 to 2	1.0"
	2-1/2 to 4	1.5"
	5 and 6	1.5"
	8 and up	1.5"
Cooling Systems (Storm Water (Drain Bodies, Horizontal and Vertical Piping), Condensate and Refrigerant)**		
	Runouts	0.5"
	1 and less	0.5"
40 - 55 (K value .23-.27 @ 75°F)	1-1/4 to 2	0.75"
	2-1/2 to 4	1.0"
	5 and 6	1.0"
	8 and up	1.0"

NOTE: Runouts to individual terminal units not exceeding 12 feet in length.

*Applies to supply and recirculating sections of domestic hot water systems.

** The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit water vapor transmission and condensation

3.2 DUCTWORK SYSTEM INSULATION

A. Dual Temperature Ductwork :

1. Application Requirements: Insulate the following cold ductwork:
 - a. Outdoor air intake ductwork between air entrance and fan inlet or HVAC unit inlet.
 - b. HVAC supply ductwork between fan discharge, or HVAC unit discharge, and room terminal outlet.
 - c. HVAC return ductwork between room terminal inlet and return fan inlet, or HVAC unit inlet; except omit insulation on return ductwork located in return air ceiling plenums.
 - d. HVAC plenums and unit housings not pre-insulated at factory.

2. Insulate each ductwork system specified above with one of the following types and thicknesses of insulation:
 - a. Flexible Insulation: Externally insulate ducts with scheduled thickness duct wrap. Furnish insulation with factory foil surface faced foilscrium vapor barrier facing. Insulation shall have an average thermal conductivity not to exceed 0.25 Btu per inch per square foot per degree F. per hour at a mean temperature of 75°F. Insulation shall have a minimum 0.75 lb. density/2.0 inches thick with insulated R-value of 6.0 and maximum at 25% compression.
 - b. Ductwork Insulation Schedule:

<u>Name</u>	<u>Insulation and Thickness</u>
All round and rectangular supply and return distribution ducts 24” diam or 48” wide and over. Use pins on the top and bottom of all flat oval ducts.	2-3/16” flexible insulation with vapor barrier jacket.
All round and rectangular cold ductwork under 24” in diam. or under 48” wide and all fresh air ductwork.	2-3/16” flexible insulation with vapor barrier jacket.
Exposed round and rectangular duct only in conditioned area with no ceiling, and exhaust ducts.	Uninsulated.

3.3 INSTALLATION OF PIPING INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to testing and acceptance of tests.
- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage.
- F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- H. Install protective metal shields and insulated inserts wherever needed to prevent compression of insulation.
- I. Pipe Hanger Insulation Inserts: Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3 inch wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3 inch wide vapor barrier tape or band.

3.4 INSTALLATION OF DUCTWORK INSULATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

- F. Fibrous Glass Ductwork: Do not insulate fibrous glass ductwork.
- G. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.
- H. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.5 PROTECTION AND REPLACEMENT

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 15250

SECTION 15400 – PLUMBING SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 DESCRIPTION OF WORK

- A. Extent of plumbing systems work is indicated on drawings and schedules, and by requirements of this section.
- B. Applications for plumbing systems include the following:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Exterior water piping.
 - 4. Sanitary sewer piping.
 - 5. Plumbing fixtures.
 - 6. Plumbing faucets.
 - 7. Floor drains and cleanouts.
 - 8. Electric water coolers.
- C. Refer to Section 15250, Mechanical Insulation, for insulation required in connection with plumbing; not work of this section.
- D. Trenching and backfill is specified in Section 15010, General Mechanical Provisions, and is included as work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of plumbing systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: A firm with at least 3 years of successful installation experience on projects with plumbing systems work similar to that required for project.
- C. Plumbing Code Compliance: Comply with applicable portions of International Plumbing Code pertaining to plumbing materials, construction and installation of products.
- D. ANSI Compliance: Comply with applicable American National Standards pertaining to products and installation of plumbing systems.
- E. CABO Standards: Comply with CABO A117.1 standard pertaining to plumbing fixtures for handicapped.

- F. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.
- G. UL Labels: Provide water coolers which have been listed and labeled by Underwriters Laboratories.
- H. ARI Labels: Provide water coolers which are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute standards.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data for the following:
 - 1. Pipe
 - 2. Fixtures
 - 3. Faucets
 - 4. Floor Drains
 - 5. Cleanouts
 - 6. Electric Water Coolers
 - 7. Electric Domestic Water Heaters

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling as required to prevent pipe-end damage and eliminate dirt and moisture from inside of pipe and tube.
- B. Where possible, store pipe and tube inside and protected from weather. Where necessary to store outside, elevate above grade and enclose with durable, waterproof wrapping. Protect fittings from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.
- C. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.
- D. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS AND PRODUCTS

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in plumbing systems. Where more than 1 type of materials or products are indicated, selection is Installer's option.

B. Domestic Water Piping - Copper Tube:

1. Wall Thickness: Type L, hard-drawn temper, ASTM B 88.
2. Type L, soft-drawn temper, ASTM B 88, allowable only where specifically noted on plans.
3. Fittings: Wrought-copper, solder-joints, ASME B16.22.
4. Solder Material: Lead free.

C. Cross-Linked Polyethylene - Interior Only:

1. Cross -Linked Polyethylene (PEX) water distribution pipe that meets standards NSF 14/61, ASTM F 876 and F 877, and CSA B 137.5. Pipe to be tested for resistance to hot chlorinated water in accordance with ASTM F 2023. Pipe to have a minimum extrapolated time-to-failure of 50 years, calculated in accordance with Section 13.3 of F 2023.
2. All fittings used with cross-linked polyethylene (PEX) water distribution pipe intended for plumbing applications shall be of the cold-expansion compression-sleeve design in accordance with ASTM F 2080.
3. Flow shall be equal to or better than copper.
4. Equivalent Manufacturers: Wirzbo, Upinor and Rehau.

D. Polypropylene PP-R (80) – Interior Only:

1. Polypropylene PP-R (80) fusion-weld water distribution pipe, pressure fittings and valves for domestic cold water (Aquatherm Greenpipe or equal) and domestic hot water (Aquatherm Greenpipe Faser or equal) that meets NSF 14/15/61, CSA-B137.11, ICC AC 122 and ASTM F 2389. Domestic hot water shall contain a fiber layer (faser) to restrict thermal expansion. Piping and fittings installed in plenums shall be pre-insulated or field insulated per manufacturer's instruction and Flume Spread Rating of 25 and Smoke Development rating of 50. Pipe shall be insulated per 2009 IECC with a factory installed and/or additional layers of factory installed and/or additional layers of factory installed thermal and vapor barrier insulation. Where it is expected that pipe will be exposed to direct ultraviolet (UV) light for more than 30 days, it shall be provided with a factory-applied, UV-resistant coating or alternative UV protection.

E. Sanitary Sewer Piping:

1. PVC: Use in general applications and where allowed by local code.
 - a. Wall Thickness: Schedule 40, ASTM D 2665.
 - b. Fittings: Solvent welded joints, ASTM D 2564 for solvent cement.
2. Cast Iron: Use where required by local codes and where specifically noted on plans.
 - a. Wall Thickness: Service Weight.
 - b. Fittings: Hub and spigot Joints Under Slabs; ASTM A 74, with compression gaskets per CISPI HSN 85.
 - c. Fittings: No-Hub Joints: CISPI 301 and 310. Do not install under concrete floor slabs.

F. Floor Drains and Cleanouts:

1. General: Provide factory-fabricated floor drains and cleanouts of size and type indicated or approved equal. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and governing regulations. All floor drains shall have traps.

2.2 PLUMBING FIXTURES AND TRIM

- A. General: Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer, and as required for a complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by a single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations. All fixtures shall have traps.
- B. Materials:
 1. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, discoloration, or other surface imperfections on finished units are not acceptable.
 2. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless steel units. Provide copper or brass where not exposed.
 3. Stainless Steel Sheets: ASTM A 167, Type 302/304, hardest workable temper, with No. 4, bright, directional polish on exposed surfaces.
 4. Steel Sheets for Baked Enamel Finish: ASTM A 591, coating Class C, galvanized-bonderized.
 5. Steel Sheets for Porcelain Enamel Finish: ASTM A 424, commercial quality, Type I.
 6. Aluminum: ASTM B 209/B 221 sheet, plate and extrusions, as indicated; alloy, temper and finish as determined by manufacturer, except 0.40 mil natural anodized finish on exposed work unless another finish is indicated.
 7. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ASME A112.19.2M.
 8. Fiberglass: ANSI Z124, smooth surfaced, with color selected by Architect/Engineer.
 9. Synthetic Stone: High quality, free from defects, glaze on exposed surfaces, stain resistant.
- C. Plumbing Fittings, Trim, and Accessories:
 1. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting stem pipes to permit outlet servicing without shut-down of water supply piping systems.
 2. Vacuum Breakers: Provide where water outlets are equipped for hose attachment.
 3. P-Traps: Include removable P-traps where drains are indicated for direct connection to drainage system. P-traps shall be chrome-plated brass, McGuire #8902 for lavatories and McGuire #8912 for sinks, or respective equal.
 4. Carriers: Provide cast-iron supports for fixtures of either graphitic gray iron, ductile iron, or malleable iron as indicated.
 5. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

6. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated sheet steel escutcheons with friction clips.
7. Stops: Install on each plumbing fixture not provided with integral stops.
8. Risers: Install hot and cold water risers on each plumbing fixture

D. Electric Water Coolers

1. Combination High/Low Unit: Unit shall be a combination high/low model suitable for single point water, drain, and power connections. Unit shall be wall mounted with one-piece stainless steel basin for each level, pushbutton front, galvanized steel chassis, with a 1/5 HP minimum compressor capable of 8.8 gallons per hour of chilled water at 50°F, based on inlet water at 80°F and room temperature at 80°F. Unit shall fully comply with Americans with Disabilities Act. Unit shall be lead-free. Unit shall use refrigerant HFC-134A. Unit shall be Elkay Model LVRCTL8WSK or equal.
2. Electric Domestic Water Heaters: Units shall be circulating hot water heaters which meet the requirements of the 2015 International Energy Conservation Code (IECC) and be provided per Contract Drawings with cold and hot water connections, pressure and temperature relief valves, glass lined tank, heating element(s), overflow drain pan, surface mounted thermostat that automatically cycles on and off to maintain the water temperature at the desired preset level, from 100°F to 150°F. Units shall be hydrostatically tested and designed for a rating of 150 psi working pressure and a 300 psi hydrostatic test.

2.3 SPECIALTIES

- A. Dielectric unions: Provide dielectric unions on all dissimilar pipe connections.
- B. Water Hammer Arresters: Provide piston type water hammer arresters, brass casing and piston, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201. Equal to Sioux Chief Manufacturing Corp., Inc.
- C. Drip Pans: Provide galvanized drip pans under water heaters located above ceilings or above floor; install elsewhere where noted on plans. Pans shall be large enough to include all of the water heater and connections likely to leak. Pans shall have drain connections with pipes to a floor drain, janitor sink, or other approved drain location.
- D. Vent Flashing: Plumbing vent lines to have sheet lead flashings of 4 pound lead extending a minimum of 15 inches in all directions from pipe and turned down into top of pipe minimum of 1 inch.
- E. Escutcheons: Provide and install chrome plated sectional floor and ceiling plates around pipe passing exposed through walls, floors, and ceilings.

2.4 SUPPORTS AND ANCHORS

- A. Piping shall be supported in accordance with ASHRAE Equipment Handbook recommendations, and the local plumbing code.
- B. Provide assemblies rated for the applied load. Hangers and supports capable of vertical adjustment under load. Hangers and supports of carbon steel, malleable iron, or cast iron,

insulated for copper pipe and tubing. Hangers and supports of chain, strap, perforated bar stock, gray cast iron, or wire not allowed or approved.

- C. Hangers and supports installed to adequately support pipe without interfering with inherent flexibility, and as required to prevent sagging and vibration. Lines shall be braced to prevent horizontal movement.
- D. Concentrated loads of valves, fittings, etc., require closer spacing of hangers and supports. Spacing shall be based on weight to be supported and on maximum recommended loads for the hanger components.
- E. On insulated piping, hangers shall be installed outside covering with sheet metal protection saddles. Under no circumstances shall hangers, supports and guides be applied directly to horizontal pipe or tubing.
- F. Pipes through the buildings, both horizontal and vertical, shall be adequately supported from the construction. Vertical pipes shall be supported from floor lines with riser clamps sized to fit the lines and to adequately support their weight. Where required for proper support, furnish and install anchor base fittings or other approved supports.
- G. Provide all pipe hangers and guides as indicated or required to properly support and anchor the piping systems. Piping in parallel shall be supported by Unistrut P-1000 or equal with P-1100 series clamps; single pipes shall be hung from rings or clamps. Size all members for weight to be carried.
- H. All horizontal cast iron pipe shall be supported every five (5) feet where joints occur, and every ten (10) feet where the pipe exceeds five (5) feet in length. Supports shall be adequate to maintain alignment and prevent sagging, and shall be placed within 18 inches of the hub or joint. Lines shall be braced to prevent horizontal movement.
- I. All horizontal copper piping shall be supported at six (6) foot spacing for pipe 1-1/2" and smaller, and at ten (10) foot spacing for pipe 2" and larger.
- J. All vertical pipes shall be supported at least once every story height and at the base.
- K. All horizontal plastic pipe shall be supported on 4-foot centers.
- L. Cross lined polyethylene pipe and polypropylene PP-R (80) pipe shall be supported per manufacturer's recommendations.
- M. Small lines supported under bar joists shall have rods run through space between the bottom angles secured with a washer and two (2) nuts. For larger lines beneath bar joists, the hanger rods shall be secured to angle irons of adequate size, with each angle spanning two or more joists as required. Angles shall be welded to the joists.
- N. For pipes supported under exposed steel beams, use beam clamps.
- O. For pipes supported under concrete slabs, use concrete inserts.
- P. Flush valve supports shall be provided for all water closet and urinal flush valves to prevent movement of valves and shall be Wal-let all brass support type or equal.

2.5 VALVES

- A. General: Provide factory-fabricated valves recommended by manufacturer for use in service indicated. Provide valves of types and pressure ratings indicated; provide proper selection as determined by Installer to comply with installation requirements. Provide sizes as indicated, and connections which properly mate with pipe, tube, and equipment connections. Where more than one type is indicated, selection is Installer's option.
- B. Ball Type, Screwed model:
 - 1. Bronze, solid wedge, screw-in bonnet, inside screw, traveling stem, Jenkins 47, Nibco T111, T121, Hammond IB640, or equal.
- C. Ball Type, Soldered model:
 - 1. Bronze, solid wedge, screw-in bonnet, inside screw, traveling stem, Jenkins 1242, Nibco S111, S121, Hammond IB635, or equal.
- D. Check Type, Screwed model:
 - 1. Bronze, regrinding bronze disk, Jenkins 92A, Nibco T413BWY, Hammond IB940, or equal.
- E. Check Type, Soldered model:
 - 1. Bronze, regrinding bronze disk, Jenkins 1222, Nibco 5433 (BY), Hammond IB945, or equal.
- F. Drain Type:
 - 1. Hammond 719, 711, or 100, or equal by Jenkins or Nibco
- G. Balancing & Shutoff Type:
 - 1. Illinois 4000 or 5000
 - 2. DeZurik 425S-787-RS55
 - 3. Sarco
- H. Balancing, Shutoff, & Flow Measurement Type:
 - 1. Illinois 6000
 - 2. Armstrong CBV-1 or 11
- I. Pressure drop shall not exceed 2 psig; provide pressure taps.
- J. Pressure & Temperature Relief Type, ASME rated:
 - 1. Watts
 - 2. Cash Acme
 - 3. McDonell-Miller
- K. Hydrants:

1. Recessed Non-Freeze Wall Hydrants: Cast-bronze box hydrant, chrome plated face, tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, hinged locking cover, 3/4" inlet, hose outlet.

PART 3 - EXECUTION

3.1 INSTALLATION OF INTERIOR DOMESTIC WATER DISTRIBUTION PIPING

- A. General: Install pipe, tube and fittings in accordance with recognized industry practices which will achieve permanently-leakproof piping systems, capable of performing each indicated service without piping failure. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment. Reduce sizes (where indicated) by use of reducing fittings. Align piping accurately at connections, within 1/16" misalignment tolerance.
- B. Locate piping runs, except as otherwise indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown or described by diagrams, details and notations or, if not otherwise indicated, run piping in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold piping close to walls, overhead construction, columns and other structural and permanent-enclosure elements of building; limit clearance to 1/2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1.0" clearance outside insulation. Wherever possible in finished and occupied spaces, conceal piping from view, by locating in column enclosures, in hollow wall construction or above suspended ceilings; do not encase horizontal runs in solid partitions, except as indicated.
- C. Electrical Equipment Spaces: Do not run piping through electrical or electronic equipment spaces and enclosures unless unavoidable. Install drip pan under piping that must be run through electrical spaces. Under no circumstances run pipes above electrical panels, motor control centers, switchboards, and similar equipment.
- D. Solder copper tube-and-fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full inside diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- E. Cross lined polyethylene (PEX) and polypropylene PP-R (80) pipe shall be supported per manufacturer's recommendations.

3.2 INSTALLATION OF EXTERIOR WATER PIPING

- A. General: Install exterior water service piping system in compliance with local governing regulations.
- B. Street Main Connection: Arrange and pay for tap in water main, of size and in location indicated, by Local Water Utility Company.

- C. Water Service Piping: Extend water service piping of size and in location indicated to water service entrance at building. Provide sleeve in foundation wall for water service entry; make entry watertight. Provide gate valve at water service entry inside building.
- D. Copper Tube: Install in accordance with recommended procedures of the Copper Development Association.
- E. Sterilization: At completion of water service line installation, flush and sterilize in conformance with International Plumbing Code, to satisfaction of local authorities having jurisdiction.

3.3 INSTALLATION OF SANITARY SEWER PIPING

- A. General: Install underground building drains as indicated and in accordance with International Plumbing Code. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Clean interior of piping of dirt and other superfluous material as work progresses. Maintain swab or drag in line and pull past each joint as it is completed. Place plugs in ends of uncompleted piping at end of day or whenever work stops.
- B. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot.
- C. Plastic Pipe/Tube Joints: Comply with manufacturer's instructions and recommendations, and with applicable industry standards. Make Solvent-Cemented Joints in accordance with ASTM D 2672.
- D. Hubless Cast-Iron Joints: Comply with CISPI 310.

3.4 INSTALLATION OF FLOOR DRAINS AND CLEANOUTS

- A. Cleanouts: Install in sanitary aboveground piping and sanitary building drain piping as indicated, as required by International Plumbing Code; and at each change in direction of piping greater than 45 degrees; at minimum intervals of 50 feet for piping 4" and smaller and 100 feet for larger piping; and at base of each vertical soil or waste stack. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.
- B. Floor Drains: Install floor drains in accordance with manufacturer's written instructions and in locations indicated. Coordinate with soil and waste piping as necessary to interface floor drains with drainage piping systems. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated. Position drains so that they are accessible and easy to maintain.

3.5 INSTALLATION OF PLUMBING FIXTURES AND TRIM

- A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations

of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until unsatisfactory conditions have been corrected.

- B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and serve intended purposes. Comply with applicable requirements to the International Plumbing Code pertaining to installation of plumbing fixtures.
- C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

3.6 INSTALLATION OF SPECIALTIES

- A. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.
- B. Drip Pans: Install under water heaters where shown. Connect drain to floor drain or janitor sink. Provide adequate support to insure uniform position when full of water.
- C. Backflow Preventers: Install backflow preventers where indicated, and where required by International Plumbing Code or local water authority. Pipe relief outlet to nearest floor drain.

3.7 INSTALLATION OF VALVES

- A. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
- B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward for horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
- C. Shutoff Valves: Install on inlet of each plumbing fixture, and elsewhere as indicated.
- D. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.
- E. Balance Cocks: Install in each hot water recirculating loop where indicated.
- F. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.
- G. Hydrants: Installed where indicated, in accordance with manufacturer's installation instructions.

3.8 CLEAN, FLUSH, AND INSPECT

- A. General: Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.

- B. Clean plumbing fixtures of dirt and debris upon completion of installation. Protect installed fixtures from damage during the remainder of the construction period.

3.9 PIPING TESTS

- A. Test soil and waste piping system in accordance with requirements of International Plumbing Code.
- B. General: Provide temporary equipment for testing, including pump and gages. Test piping system before insulation is installed wherever feasible, and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating. Fill each section with water and pressurize for indicated pressure and time.
- C. Repair piping systems sections which fail required piping test by disassembly and re-installation, using new materials to extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
- D. Drain test water from piping systems after testing and repair work has been completed.

3.10 FIELD QUALITY CONTROL

- A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.
- B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

END OF SECTION 15400

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SECTION 15500 – FIRE PROTECTION SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 DESCRIPTION OF WORK

- A. The work includes designing and providing new automatic wet pipe fire extinguishing sprinkler systems for Light Hazard Occupancy throughout the facility (including lobby, offices, conference rooms, break room, work rooms, viewing rooms, and reception areas) and an Ordinary Hazard Group 1 occupancy for mechanical room, storage room, and janitor room. Provide uniform distribution of water by hydraulic design to afford complete fire protection coverage throughout the facility. Contractor shall study the floor plans to determine the specific hazard occupancy for each room of the facility, and design accordingly. Contractor shall study the architectural, structural, mechanical, and electrical plans to determine available space, conflicts, etc. Especially critical are the various changes in ceiling height, changes in ceiling type, sloped ceilings, open structures, and special ceiling finishes in lobby and teller areas. The design, equipment, materials, installation, and workmanship shall be in strict accordance with the required and advisory provisions of NFPA 13, except as modified herein. System shall include all materials, accessories, and equipment necessary to be complete and ready for use. Design and install each system to give full consideration to blind spaces, piping, electrical equipment, ductwork, and all other construction and equipment to afford complete coverage in accordance with detailed drawings to be submitted for approval. Devices and equipment for fire protection service shall be listed by the Underwriters' Laboratories, Inc, and approved by the Factory Mutual System. In the NFPA publications referred to herein, the advisory provisions shall be considered to be mandatory, as though the word "shall" had been substituted for "should" wherever it appears.
 - 1. Sprinkler system is not required under exterior open shade canopies.
 - 2. Available space above ceiling is limited. Coordinate with other trades.
 - 3. Plastic piping is not acceptable.
 - 4. Install guards on all heads subject to physical damage.
 - 5. Full consideration shall be give to aesthetic considerations of facility. Heads shall be symmetrically located in rooms or areas served. Finished heads shall be installed in all finished areas. Heads shall be located in the center of all ceiling tiles.
 - 6. Architect reserves the right to adjust head locations, and if necessary, head quantities during submittal phase.
- B. Trenching and backfill required in conjunction with fire protection piping is specified in applicable Division-2 sections, and is included as work of this section, as noted herein.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of fire protection piping systems products, of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: A firm with at least 3 years of successful installation experience on projects with fire protection piping systems work similar to that required for project.
- C. NFPA Code: Comply with ANSI/NFPA 13, "Installation of Sprinkler Systems".
- D. FM Compliance: Comply with Factory Mutual "Approval Guide".
- E. FM Labels: Provide sprinkler products bearing FM approval labels.
- F. UL Labels: Provide fire sprinkler piping products which have been approved and labeled by Underwriters Laboratories.
- G. Local Fire Department/Marshall Regulations: Comply with governing regulations pertaining to fire sprinkler piping.

1.4 SUBMITTALS

- A. Partial submittals will not be acceptable. Annotate descriptive data to show the specific model, type, and size of each item the Contractor proposes to furnish. Prepare working drawings in accordance with the requirements of "Working Drawings (Plans)" as specified in NFPA 13, and include data essential to the proper installation of each system. Do not commence work until the design of each system and the various components have been approved. Before any work is commenced, submit for approval complete sets of working drawings and calculations for each sprinkler system.
- B. Manufacturer's Data:
 - 1. Pipe, fittings, and mechanical couplings
 - 2. Alarm valves
 - 3. Valves, including gate, check, and globe
 - 4. Water-motor alarms
 - 5. Sprinkler heads
 - 6. Pipe hangers
 - 7. Pressure switch
 - 8. Fire department siamese connection
 - 9. Vertical backflow preventer
- C. Shop Drawings:
 - 1. Sprinkler system layout
 - 2. Hydraulic calculations
 - 3. Contractor's material and test certificate
- D. Operation and Maintenance Manuals:
 - 1. Alarm valves

1.5 AS-BUILT (RECORD) WORKING DRAWINGS

- A. After completion, but before final acceptance of the work, furnish a complete set of drawings of each sprinkler system for record purposes. The drawings shall be reproducible.

PART 2 - PRODUCTS

2.1 FIRE PROTECTION DESIGN, PIPING MATERIALS, AND PRODUCTS

- A. Design of Sprinkler Systems: Design of wet pipe fire extinguishing sprinkler systems shall be by hydraulic calculations for uniform distribution of water over the design area and shall conform to NFPA 13 and to the requirements as specified herein.
- B. Distribution of Water: Distribution shall be essentially uniform throughout the area in which it is assumed the sprinkler heads will open. Variation in discharge from individual heads in the hydraulically most remote area shall be between 100 and 120 percent of the specified density.
- C. Density of Application of Water: Size pipe to provide the specified density when the system is discharging the specified total maximum required flow.
- D. Sprinkler Discharge Area: Area shall be the hydraulically most remote area as defined in NFPA 13.
- E. Outside Hose Allowances: Hydraulic calculations shall include hose allowances as required by NFPA 13.
- F. Location of Sprinkler Heads: Heads in relation to the ceiling and the spacing of sprinkler heads shall not exceed that permitted by NFPA 13. The spacing of sprinklers on the branch lines shall be essentially uniform.
- G. Water Supply: Base hydraulic calculations on flow data shown on plans. Contractor shall verify flow data before starting work.

2.2 EQUIPMENT

- A. Sprinkler Heads-General: Heads shall have nominal 1/2-inch, 17/32-inch, or 0.64-inch orifice as specified. Release element of each head shall be of the intermediate temperature rating or higher as suitable for the individual location where it is installed. Provide fully recessed pendent sprinklers with white cover plates in gypboard and lay-in ceilings. Provide fully recessed pendent sprinklers with cover plates (color to be coordinated with architect) for wood ceilings. Provide brass finish for upright heads.
- B. Cabinet: Provide extra sprinkler heads and sprinkler head wrench in a metal cabinet adjacent to the alarm valve within the building. The number and types of extra sprinkler heads shall be as specified in NFPA 13.
- C. Alarm Valve: Provide variable pressure type alarm valve complete with retarding chamber, alarm test valve, alarm shutoff valve, drain valve, pressure gauges, accessories, and appurtenances necessary for the proper operation of the system.

- D. Water Flow Alarm: Alarm shall be through the fire alarm system; coordinate with fire alarm contractor.
- E. Pressure Switch: Provide switch with circuit opener or closer for the automatic transmittal of an alarm over the facility fire alarm system and connect into the fire alarm system. Alarm actuating device shall be of the mechanical diaphragm controlled water pressure type with retard device adjustable from 10 to 60 seconds and shall be of a type which instantly recycles when pressure is released on the diaphragm. Install the switch in the alarm valve trim ahead of all valves so that the switch cannot be shut off.

2.3 ABOVE GROUND PIPING SYSTEMS

- A. Inspect, test, and approve piping before burying, covering, or concealing. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through tapered reducing pipe fittings; the use of bushings will not be permitted. Welding shall be performed in the shop; field welding will not be permitted.
- B. Sprinkler Pipe and Fittings: Provide and install in accordance with NFPA 13. Fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded shall be welded, threaded, or grooved-end type. Use of plain-end fittings with mechanical couplings (which utilize steel gripping devices to bite into the pipe when pressure is applied) will not be permitted. Rubber gasketed grooved-end pipe and fittings with mechanical couplings shall be permitted in pipe sizes 1.25 inches and larger; fittings shall be UL Listed or FM approved for use in sprinkler systems.
- C. Pipe Hangers: Provide and install in accordance with NFPA 13.
- D. Valves: Provide valves as required by NFPA 13 and of types approved for fire service. Gate valves shall open by counterclockwise rotation. Check valves shall be flanged clear opening swing check type with flanged inspection and access cover plate for sizes 4 inches and larger. Provide an OS&Y valve beneath each alarm valve in each riser when more than one alarm valve is supplied from the same water supply pipe.
- E. Identification Signs: Attach properly lettered approved metal signs conforming to NFPA 13 to each valve and alarm device. Permanently affix hydraulic design data nameplates to the riser of each system.
- F. Inspectors' Test Connections: Provide test connections about 6 feet above the floor for each sprinkler system or portion of each sprinkler system equipped with an alarm device and locate at the hydraulically most remote part of each system. Provide test connection piping to a location where the discharge will be readily visible and where water may be discharged without damage.
- G. Main Drains: Provide drain piping to discharge at safe points outside each building or to sight cones attached to drains of adequate size to readily receive the full flow from each drain under maximum pressure. Provide auxiliary drains as required by NFPA 13.
- H. Pipe Sleeves: Provide where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 0.25-inch space between exterior of piping or pipe insulation and interior of sleeve. Firmly pack space with

insulation and caulk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass, or provide a segmented elastomeric seal.

1. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide ASTM A 53 or ASTM A 120, Schedule 40 or Standard Weight, zinc-coated steel pipe sleeves. Extend sleeves in floor slabs 3 inches above the finished floor.
2. Sleeves in Partitions and Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide zinc-coated steel sheet having a nominal weight of not less than 0.90 pounds per square foot.
3. Escutcheon Plates: Provide one piece or split hinge type metal plates for piping passing through floors, walls, and ceilings in exposed areas. Provide chromium-plated finish on plates in finished areas. Provide paint finish on plates in unfinished areas. Securely anchor plates in place with set screws or other approved positive means.
4. Fire Department Inlet Connections: Provide inlet connections about 3 feet above grade, of the approved two-way type with 2.5 inch National Standard female hose threads with plug and chain.

2.4 BURIED WATER PIPING SYSTEMS

- A. Pipe and Fittings: Provide outside coated, cement mortar lined, ductile-iron pipe and fittings conforming to NFPA 24 for piping under the building and less than 5 feet outside of the building walls. Anchor the joints in accordance with NFPA 24; provide concrete thrust block at the elbow where the pipe turns up toward the floor, and restrain the pipe riser with steel rods from the elbow to the flange above the floor. Minimum depth of cover shall be 3 feet. Piping more than 5 feet outside of the building walls shall be PVC plastic pressure pipe, AWWA C900, 200 psi pressure class, with rubber gasket push on joints.
- B. Valves: Provide as required by NFPA 24. Gate valves shall conform to AWWA C500 or UL 262 with cast-iron body and bronze trim and shall open by counterclockwise rotation.
- C. Buried Utility Warning and Identification Tape: Provide detectable aluminum foil plastic backed tape or detectable magnetic plastic tape manufactured specifically for warning and identification of buried piping. Tape shall be detectable by an electronic detection instrument. Provide tape in rolls, 3 inches minimum width, color coded for the utility involved with warning and identification imprinted in bold black letters continuously and repeatedly over entire tape length. Warning and identification shall be CAUTION BURIED WATER PIPING BELOW or similar. Use permanent code and letter coloring unaffected by moisture and other substances contained in trench backfill material. Bury tape with the printed side up at a depth of 6 inches below the top surface of earth or the top surface of the subgrade under pavements.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Equipment, materials, installation, and workmanship shall be in accordance with NFPA 13, except as modified herein. Install piping straight and true to bear evenly on hangers. Keep the interior and ends of new piping affected by the Contractor's operations thoroughly cleaned of water and foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping and fittings so that water and foreign matter will not enter the pipes or fittings. Inspect piping before placing into position.

3.2 DISINFECTION

- A. Disinfect the new water piping in accordance with AWWA C601. Fill the piping systems with solution containing minimum of 50 parts per million of available chlorine and allow solution to stand for minimum of 24 hours. Flush the solution from the systems with clean water until maximum residual chlorine content is not greater than 0.2 parts per million.

3.3 FIELD PAINTING: See Division 9.**3.4 FIELD TESTING AND FLUSHING**

- A. Hydrostatically test each system at 200 psig for a period of 2 hours. Flush piping in accordance with NFPA 13. Piping above suspended ceilings shall be tested, inspected, and approved before installation of ceilings. Test the alarms and other devices. Test the water flow alarms by flowing water through the inspector's test connection. When tests have been completed and corrections made, submit a signed and dated certificate, similar to that specified in NFPA 13, with a request for a formal inspection and tests.

END OF SECTION 23821

SECTION 15653HP - HEAT PUMP CONDENSING UNITS**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of condensing unit work is indicated by drawings and schedules, and by requirements of this section. Each unit is defined to include (but not by way of limitation) fans and motors, refrigeration equipment, casing, controls, coils, and thermal insulation.
- B. Refer to Division-16 sections for electrical connections required for condensing units; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of condensing units of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering heat pump condensing units which may be incorporated in the work include, but are not limited to, the following:
 - 1. Carrier A/C Group, Carrier Corp.
 - 2. Lennox Industries, Inc.
 - 3. Trane Co.
 - 4. York Div., Borg-Warner Corp.
- C. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 90A, "Air-Conditioning and Ventilating Systems", pertaining to installation of electric heating coils.
- D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 70, "National Electric Code", pertaining to construction and installation of electrically operated components of condensing units.
- E. Flame-Smoke Ratings: Except as otherwise indicated, provide condensing unit thermal insulation with flame-spread index of 25 or less, fuel-contributed index of 50 or less, and smoke-developed index of 50 or less.
- F. AMCA Standards: Comply with Air Movement and Control Association (AMCA) standards as applicable to testing and rating fans.
- G. ASHRAE Compliance: Provide refrigerant coils complying with construction and testing standards of ANSI/ASHRAE 15 "Safety Code for Mechanical Refrigeration".

- H. Industry Standards: Except as otherwise indicated, comply with ASHRAE recommendations pertaining to condensing units.
- I. ARI Certification: Provide central station packaged air handling units which comply with Air-Conditioning and Refrigeration Institute (ARI) Standards 210, 410, and 430 and display ARI's certification symbols.
- J. UL Compliance: Provide electric components for condensing units which have been listed and labeled by Underwriters Laboratories.
- K. IECC Compliance: All condensing units shall comply with requirements of 2006 International Energy Conservation Code.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications for condensing units showing dimensions, weights, capacities, ratings, motor electrical characteristics, gages and finishes of materials, capacity and efficiency data, and installation instructions.
- B. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
- C. Maintenance Data: Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data in maintenance manuals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver condensing units with factory-installed shipping skids and lifting lugs; pack components in factory-fabricated protective containers.
- B. Handle condensing units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to condensing unit manufacturer.
- C. Store condensing units in clean dry place and protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 CONDENSING UNITS

- A. General: Provide factory-built and factory-tested condensing units as indicated, of sizes and capacities as scheduled, and as specified herein. Units shall be factory assembled and prewired, consisting of cabinet and frame, controls, refrigerant cooling coil, compressor, and condenser coil with fan(s).

2.2 CONSTRUCTION

- A. Cabinet: Steel with baked enamel finish, access doors or removable access panels with quick fasteners, locking door handle type or screwdriver operated flush cam type. Structural members shall be minimum 18 gage with access doors or removable panels, minimum 20 gage.

2.3 COMPRESSOR

- A. Provide hermetic compressor, 1750 RPM, resiliently mounted with positive lubrication, crankcase heater, electric actuated unloading, high and low pressure safety controls, motor overload protection, reversing valve(s), service valves, and filter drier. Unit shall have rubber-in-shear isolators.
- B. Timed off circuit shall limit number of compressor starts to 12 per hour.
- C. System shall operate on refrigerant 410A.

2.4 CONDENSER

- A. Provide copper tube aluminum fin coil assembly with sub-cooling rows.
- B. Provide direct drive axial fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.
- C. Provide refrigerant pressure switch to cycle condenser fans.

2.5 REFRIGERATION CIRCUITS

- A. Units shall have single refrigerant circuits.

2.6 LOW AMBIENT OPERATION

- A. Unit shall be capable of standard start and stop operation to 40 F ambient temperature.

END OF SECTION 15653HP

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SECTION 15766 - HEAT PUMP AIR HANDLING UNITS WITH ELECTRIC HEAT**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of air handling unit work is indicated by drawings and schedules, and by requirements of this section. Each unit is defined to include (but not by way of limitation) fan and motor, filter, cooling and dehumidifying coil, electric heat coil, drip pan, and thermal insulation. Unit shall be suitable for heat pump operation.
- B. Refer to Division-16 sections for electrical connections required for air handling units; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of packaged air handling units of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering air handling units which may be incorporated in the work include, but are limited to, the following:
 - 1. Carrier A/C Group, Carrier Corp.
 - 2. Trane Co.
 - 3. York Div., Borg-Warner Corp.
 - 4. Lennox
- C. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 90A, "Air-Conditioning and Ventilating Systems", pertaining to installation of electric heating coils.
- D. NFPA Compliance: Comply with applicable provisions of ANSI/NFPA 70 "National Electric Code", pertaining to construction and installation of electrically operated components of packaged air handling units.
- E. Flame-Smoke Ratings: Except as otherwise indicated, provide air handling unit thermal insulation with flame-spread index of 25 or less, fuel-contributed index of 50 or less, and smoke-developed index of 50 or less.
- F. AMCA Standards: Comply with Air Movement and Control Association (AMCA) standards as applicable to testing and rating fans, and testing louvers, dampers, and shutters.
- G. SMACNA Compliance: Comply with Sheet Metal and Air-Conditioning Contractors National Association (SMACNA) ductwork construction standards as applicable to air handling units.

- H. ASHRAE Compliance: Provide refrigerant coils complying with construction and testing standards of ANSI/ASHRAE 15 "Safety Code for Mechanical Refrigeration".
- I. Industry Standards: Except as otherwise indicated, comply with ASHRAE recommendations pertaining to air handling units.
- J. ARI Certification: Provide air handling units which comply with Air-Conditioning and Refrigeration Institute (ARI) Standard 430 and display ARI's certification symbols.
- K. UL Compliance: Provide electric components for air handling units which have been listed and labeled by Underwriters Laboratories.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications for air handling units showing dimensions, weights, capacities, ratings, fan performance with operating point clearly indicated, motor electrical characteristics, gages and finishes of materials, and installation instructions.
- B. Maintenance Data: Submit maintenance instructions, including lubrication instructions, filter replacement, motor and drive replacement, and spare parts lists. Include this data in maintenance manuals.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Handle air handling units carefully to avoid damage to components, enclosures, and finish. Do not install damaged components; replace and return damaged components to air handling unit manufacturer.
- B. Store air handling units in clean dry place and protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 AIR HANDLING UNITS

- A. General: Provide factory built and factory-tested air handling units as indicated, of sizes and capacities as scheduled, and as specified herein.
- B. Casings: Construct casings of 20 ga. steel, with baked enamel finish. Provide casing panels that are easily and quickly removable for inspection and access to internal parts. Provide insulated drain pan under coil. Insulate casing with 1" fiberglass insulation.
- C. Coils: Coils shall be removable from the unit without dismantling the entire unit. Coils shall have continuous plate-fin surface, with seamless copper tubes expanded into aluminum fin collars for secure bonding. Casings shall be galvanized steel. Each coil shall be leak tested before shipment. Provide coil defrost package.
 - 1. Capacities, pressure drops and selection procedure shall be certified in accordance with ARI Standard 410-72.
- D. Centrifugal Fans: Before shipment, each fan shall be dynamically balanced and run tested while installed in the unit casing.

- E. Motors: Motors shall be permanent split capacitor, mounted on base furnished by the unit manufacturer.
- F. Service Access: All components in blower and coil section shall be completely accessible for service through removable panels.
- G. Filters: Filters shall be of the pleated throw away media type. Media shall be one inch (1") thick. Filters shall be equipped with draw-out straps. Furnish a complete set of extra filter media for each unit on the Project. Do not operate any air handling equipment without filters in place and properly operating.
- H. Electric Coil: Finned tube, helical coil or expanded strip heating elements, easily accessible with protection against no flow or low air flows, shorts and grounds, and failure of protection devices.
- I. Provide high limit temperature control to de-energize heating elements.
- J. Provide controls to start supply fan before electric elements are energized and continue operating until bonnet temperature reaches minimum setting. Include switch for continuous fan operation.
- K. Thermostat: Provide programmable thermostat with night set-back.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which air handling units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF AIR HANDLING UNITS

- A. Install air handling units where indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that units comply with requirements and serve intended purposes.
- B. Coordinate with other work, including ductwork, floor construction, roof decking, and piping, as necessary to interface installation of air handling units with other work.

3.3 TESTING

- A. Upon completion of installation of air handling units, start-up and operate equipment to demonstrate capability and compliance with requirements. Field correct malfunctioning units, then retest to demonstrate compliance.

3.4 EXTRA STOCK

- A. Provide 1 complete extra set of filters for each air handling unit. Install new filters at completion of air handling system work, and prior to testing, adjusting, and balancing work. Obtain receipt from Owner that new filters have been installed.

END OF SECTION 15766

SECTION 15830 - POWER VENTILATORS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 DESCRIPTION OF WORK

- A. Extent of power ventilator work is shown on drawings and schedules, and by requirements of this section.
- B. Types of power ventilators required for project include the following:
 - 1. Power ventilators.
 - a. Ceiling mounting ventilators.
- C. Refer to Division-15 section "Prefabricated Equipment Supports" for ventilator curbs; not work of this section.
- D. Refer to Division-7 sections for ventilator curbs; not work of this section.
- E. Refer to Division-7 sections for flashing of ventilator curbs; not work of this section.
- F. Flashing of ventilator curbs is specified in Division-15 Basic Materials and Methods section "Supports, Anchors, and Seals", and is work of this section.
- G. Refer to Division-16 sections for electrical work required in conjunction with power ventilators; not work of this section.
- H. Refer to other Division-15 temperature control systems sections for control work required in conjunction with power ventilators; not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of power and gravity ventilators, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. AMCA Compliance: Provide power roof ventilators bearing the Air Movement and Control Association, Inc. (AMCA) Certified Ratings Seal.
- C. UL Compliance: Provide power roof ventilator electrical components which have been listed and labeled by Underwriters Laboratories (UL).

1.4 SUBMITTALS

- A. **Product Data:** Submit manufacturer's data for power and gravity ventilators, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.
- B. **Shop Drawings:** Submit assembly-type shop drawings showing unit dimensions, construction details, and field connection details.
- C. **Maintenance Data:** Submit maintenance instructions, including lubrication instructions, motor and drive replacement, and spare parts lists. Include this data in maintenance manuals.

PART 2 - PRODUCTS

2.1 POWER VENTILATORS

- A. **General:** Except as otherwise indicated, provide standard prefabricated power ventilator units of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.
- B. **Centrifugal ceiling Ventilators:** Provide centrifugal ceiling type, power ventilators of type, size, and capacity as scheduled, and as specified herein.
 - 1. **Type:** Centrifugal fan, direct or belt driven as scheduled. Designed for installing in ceiling for concealed in-line applications..
 - 2. **Electrical:** Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor.
 - 3. **Housing:** Steel, lined with acoustical insulation.
 - 4. **Fan Wheel:** Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service
 - 5. **Grille:** Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
 - 6. **Variable-Speed Controller:** Solid-state control to reduce speed from 100 to less than 50 percent.
 - 7. **Isolation:** Rubber-in-shear vibration isolators.
 - 8. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering centrifugal roof ventilators which may be incorporated in the work include, but are limited to, the following:
 - a. Acme Engineering and Mfg. Corp.
 - b. Briedert Co.
 - c. Carnes Co., Div. of Wehr Corp.
 - d. Cook (Loren) Co.
 - e. Greenheck Fan Corp.
 - f. Penn Ventilator Co., Inc.

PART 3 - EXECUTION**3.1 INSPECTION**

- A. General: Examine areas and conditions under which power and gravity ventilators are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF POWER VENTILATORS

- A. General: Except as otherwise indicated or specified, install ventilators in accordance with manufacturer's installation instructions and recognized industry practices to insure that ventilators serve their intended function.
- B. Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.
- C. Ensure that power ventilators are wired properly, with correct motor rotation, and positive electrical motor grounding.
- D. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

3.3 TESTING

- A. General: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of units at performance requirements specified. When possible, field correct malfunctioning units, and then retest to demonstrate compliance. Replace units which cannot be satisfactorily corrected.
- B. Refer to Division-15 section "Testing, Adjusting, and Balancing;" not work of this section.

3.4 SPARE PARTS

- A. General: Furnish to Owner, with receipt, 1 spare set of belts for each belt drive power ventilator.

END OF SECTION 15830

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SECTION 15840 - AIR DISTRIBUTION SYSTEM**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

- A. Extent of air distribution system is indicated on drawings and in schedules, and by requirements of this section. Low pressure ductwork is hereby defined as ductwork subjected to velocities of 2500 fpm or less, and operating pressure of 2" w.g. or less, positive or negative.
- B. Types of low pressure ductwork required for project include the following:
 - 1. Heating and air-conditioning supply and return air systems.
 - 2. Exhaust and relief systems.
- C. Types of duct accessories required for project include the following:
 - 1. Dampers.
 - a. Low pressure manual dampers.
 - b. Control dampers.
 - c. Fire and smoke dampers.
 - d. Turning vanes.
 - e. Duct access doors.
 - f. Flexible connections.
 - g. Flexible duct.
 - h. Spin-in taps.
- D. Types of outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - 2. Wall registers and grilles.
 - 3. Louvers.
- E. Insulation for low pressure ductwork is specified in Section 15250, Mechanical Insulation, and is included as work of this section.
- F. Balancing of outlets and inlets is specified in Section 15990, and is included as work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of outlets, inlets, and duct accessories of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.

- B. Installer: A firm with at least 3 years of successful installation experience on projects with low pressure ductwork systems work similar to that required for project.
- C. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of low pressure ductwork.
- D. ASHRAE Standards: Comply with Standard 70 "Methods of Testing for Rating the Air Flow Performance of Outlets and Inlets."
- E. NFPA Compliance: Comply with NFPA 90A "Installation of Air-Conditioning and Ventilating Systems" and NFPA 90B "Installation of Warm Air Heating and Air-Conditioning Systems."
- F. ADC Standards: Comply with Air Diffusion Council (ADC) Standard 1062:GRD "Test Codes for Grilles, Registers, and Diffusers." Provide outlets and inlets bearing the ADC Certified Ratings Seal.
- G. AMCA Standards: Comply with Air Movement and Control Association, Inc. (AMCA) Standard 500 "Test Method for Louvers, Dampers and Shutters." Provide louvers bearing the AMCA Certified Ratings Seal.
- H. UL Compliance: Construct, test, and label fire dampers in accordance with Underwriters Laboratories (UL) Standard 555 "Fire Dampers and Ceiling Dampers."

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications on the following duct accessories:
 - 1. Submit manufacturer's data on outlets and inlets including the following:
 - 2. Schedule of outlets and inlets indicating drawing designation, model number, size, and accessories furnished.
 - 3. Data Sheet for each type of outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
 - 4. Performance data for each type of outlet and inlet furnished, throw and drop, and noise criteria ratings. Indicate selections on data.
- B. Shop Drawings: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
- C. Record Drawings: At project closeout, submit record drawings of installed ductwork, duct accessories, and outlets and inlets; in accordance with requirements of Division I.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect shop-fabricated and factory-fabricated ductwork, from damage during shipping, storage and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings. Store ductwork inside and protect from weather.
- B. Deliver outlets, inlets, and duct accessories wrapped in factory-fabricated fiber-board type containers. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

PART 2 - PRODUCTS**2.1 DUCTWORK MATERIALS**

- A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains and discolorations, and other imperfections, including those which would impair painting.
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 653, lockforming quality, with zinc coating.

2.2 MISCELLANEOUS DUCTWORK MATERIALS

- A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
- B. Ductwork Liner: Fibrous glass, complying with ASTM C 1071, Type I, 1-1/2" thick. Ductwork liner shall be equivalent to Knauf Duct Liner E-M, 1.5 lbs. per cu.ft., 1-1/2" thickness. Duct liner shall comply with the 2006 International Energy Conservation Code (IECC).
- C. Duct Liner Adhesive: Comply with ASTM C 916.
- D. Duct Liner Fasteners: Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
- E. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
- F. Duct Cement: Non-hardening migrating mastic or liquid neoprene based cement (type applicable for fabrication/installation detail) as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork.
- G. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
 - 1. Interior support materials of not less than 1/4" diameter or 3/16" thickness may be plain (not galvanized).

2.3 FABRICATION

- A. Shop fabricate ductwork in 4, 8, 10 or 12-foot lengths, unless otherwise indicated or required to complete runs. Pre-assemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.
- B. Shop fabricated ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards, Metal and Flexible."

- C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.
- D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible.
- E. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners.

2.4 FACTORY-FABRICATED DUCTWORK

- A. General: At installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct and fittings.
- B. Material: Galvanized steel complying with ASTM A 653, lockforming quality, with zinc coating.
- C. Gauge: 26 Ga. minimum for round and oval ducts and fittings, 4" through 24" diameter.
- D. Gauge: 24 Ga. minimum for round and oval ducts and fittings, 26" diameter and larger.
- E. Elbows: One piece construction for 90 and 45 elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.
- F. Divided Flow Fittings: 90 tees, constructed with saddle tap spot welded and bonded to duct fitting body.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering factory-fabricated ductwork which may be incorporated in the work include, but are not limited to, the following:
 - 1. United Sheet Metal Div., United McGill Corp.

2.5 DAMPERS

- A. Low Pressure Manual Dampers: Provide dampers of single blade type or multiblade type, constructed in accordance with SMACNA-06 "HVAC Duct Construction Standards, Metal and Flexible".
- B. Control Dampers: Provide dampers with parallel blades for 2-position control, or opposed blades for modulating control. Construct blades of 16 Ga. steel, provide heavy-duty molded self-lubricating nylon bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/4" x 16 Ga. channel for face areas over 25 sq. ft. Provide galvanized steel finish with aluminum touch-up.
- C. Control Damper Operators: Damper operators shall be 24 volt or 120 volt electric as scheduled. Operators shall be direct coupled to the damper. Operators shall be selected with adequate power to completely open and close the damper under all operating conditions.

- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering dampers which may be incorporated in the work include, but are not limited to, the following:
1. Air Balance Inc.
 2. Airguide Corp.
 3. Airstream Products Div., Penn Ventilator Co., Inc.
 4. Ruskin Mfg. Co.

2.6 FIRE AND SMOKE DAMPERS

- A. Fire/Smoke Dampers: Provide fire/smoke dampers, of types and sizes indicated. Construct casings of 11 Ga. galvanized steel with bonded red acrylic enamel finish. Provide fusible link rated at 160-165 F unless otherwise indicated. Provide additional frangible link containing explosive charge, connected in series with fusible link. Provide stainless steel spring loaded leakage seals in sides of casing, and 36" long wire leads for connecting smoke link to smoke detector.
- B. Motor-Driven Fire/Smoke Dampers: Provide motor-driven fire/smoke dampers in types and sizes indicated, with casing constructed of 11 Ga. galvanized steel with bonded red acrylic enamel finish, fusible link 160-165 F, unless otherwise indicated, and curtain type stainless steel interlocking blades, with electric motor equipped with instant closure clutch, stainless steel cable damper blade linkage, motor mounting bracket, and 32" long wire leads for connecting to smoke detector. Mount motor outside air stream.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fire and smoke dampers which may be incorporated in the work include, but are not limited to, the following:
1. Air Balance Inc.
 2. Airstream Products Div., Penn Ventilator Co., Inc.
 3. Ruskin Mfg. Co.

2.7 TURNING VANES

- A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" o.c., supported with bars perpendicular to blades set at 2" o.c., and set into side strips suitable for mounting in ductwork.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering turning vanes which may be incorporated in the work include, but are not limited to, the following:
1. Air Filter Corp.
 2. Anemostat Products Div., Dynamics Corp. of America.
 3. Barber-Colman Co.
 4. Duro-Dyne Corp.
 5. Tuttle & Bailey Div. of Interpace Corp.

2.8 SPIN-IN TAPS

- A. General: Provide sheet metal spin-in taps with integral locking balancing damper. Provide taps constructed of galvanized sheet metal in accordance with SMACNA-06 "HVAC Duct

Construction Standards, Metal and Flexible". Dot Metals M500SD for metal ductwork, DBSD for fiberglass, or equal.

2.9 DUCT HARDWARE

- A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
 2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct hardware which may be incorporated in the work include, but are not limited to, the following:
1. Ventfabrics, Inc.
 2. Young Regulator Co.

2.10 DUCT ACCESS DOORS

- A. General: Provide where indicated or where required for access to dampers or other equipment item, duct access doors of size indicated.
- B. Construction: Construct of same or greater gauge as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. Provide one side hinged, other side with 1 handle-type latch for doors 12" high and smaller, or 2 handle-type latches for larger doors.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering duct access doors which may be incorporated in the work include, but are not limited to, the following:
1. Air Balance Inc.
 2. Duro Dyne Corp.
 3. Ruskin Mfg. Co.
 4. Ventfabrics, Inc.
 5. Zurn Industries, Inc., Air Systems Div.

2.11 FLEXIBLE CONNECTIONS

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment.

2.12 FLEXIBLE DUCT

- A. Provide factory-fabricated, flexible duct for connections between low velocity trunk ducts and supply air diffusers. Duct to be rated for a minimum positive working pressure of 1-1/2 inches of water. Insulated low pressure flexible duct shall be a factory assembly of 1 inch thick fiberglass (1 lb. per cu. ft. density) inside two vapor barrier materials (inside and outside surfaces) wrapped around a spring helix for support. Provide Flexmaster Type 8M, or equivalent. Flexible ductwork shall be provided with insulation thickness in accordance with the 2006 International Energy Conservation Code (IECC).

2.13 CEILING AIR DIFFUSERS

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems which will contain each type of ceiling air diffuser.
- D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on diffuser schedule. The following requirements shall apply to nomenclature indicated on schedule:
 1. Diffuser Faces:
 - a. Round: Round housing, core of concentric rings, round duct connection.
 - b. Square: Square housing, core of square concentric louvers, square or round duct connection.
 - c. Rectangular: Rectangular housing, core of rectangular concentric louvers, square or round duct connection.
 - d. Panel: Square or rectangular housing extended to form panel to fit in ceiling system module, core of square or rectangular concentric louvers, square or round duct connection.
 - e. Perforated: Round, square, or rectangular housing covered with removable perforated panel in frame. Conceal air pattern devices above panel.
 - f. Linear: Extruded aluminum continuous slot, single.
 2. Diffuser Mountings:
 - a. Flush: Diffuser housing above ceiling surface with flush perimeter flange and gasket to seal against ceiling.
 - b. Lay-In: Diffuser housing sized to fit between ceiling exposed suspension tee bars and rest on top surface of tee bar.
 3. Diffuser Patterns:
 - a. Fixed: Fixed position core with concentric rings or louvers for radial air flow around entire perimeter of diffuser.

- b. Adjustable: Manual adjustable core with concentric rings or louvers, fully adjustable for horizontal to vertical air flow.
 - c. Supply and Return: 2 section core, center position for return, perimeter for supply.
 - d. 1-, 2-, 3-, or 4-Way: Fixed louver face for directional air flow; direction indicated on drawings.
 - e. Rearrangeable Core: Modular directional core which can be rearranged for selected air pattern.
4. Diffuser Dampers:
- a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of diffuser.
 - b. Supply and Return: For supply and return diffusers, butterfly type damper in return neck, annular adjustable dampers in supply duct.
 - c. Integral: A combination volume control and pattern adjustment for linear diffusers.
 - d. Fire Damper: A combination adjustable opposed blade damper and fusible link fire damper with UL approved link and assembly designed to meet requirements of ANSI/NFPA 90A.
5. Diffuser Accessories:
- a. Operating Keys: Tools designed to fit through diffuser face and operate volume control device and/or pattern adjustment.
6. Diffuser Finishes:
- a. Aluminum Enamel: Air-dried aluminum enamel prime finish.
 - b. White Enamel: Semi-gloss white enamel prime finish.
 - c. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.
7. Available Manufacturers: Subject to compliance with requirements, manufacturers offering diffusers which may be incorporated in the work include, but are not limited to, the following:
- a. Anemostat Products Div., Dynamics Corp. of America.
 - b. E.H. Price Limited
 - c. Krueger Mfg. Co.
 - d. Metal Industries, Inc.
 - e. Titus, Div. of Philips Industries
 - f. Tuttle & Bailey Div. of Interpace Corp.

2.14 WALL REGISTERS AND GRILLES

- A. General: Except as otherwise indicated, provide manufacturer's standard wall registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide wall registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with

accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction which will contain each type of wall register and grille.

- D. Types: Provide wall registers and grilles of type, capacity, and with accessories and finishes as listed on register and grille schedule. The following requirements shall apply to nomenclature indicated on schedule:
1. Register and Grille Materials:
 - a. Steel Construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.
 - b. Aluminum Construction: Manufacturer's standard extruded aluminum frame and adjustable blades.
 2. Register and Grille Faces:
 - a. Double Deflection Straight Blades: Horizontal and vertical blades, individually adjustable, at manufacturer's standard spacing.
 3. Register and Grille Dampers:
 - a. Opposed Blade: Adjustable opposed blade damper assembly, key operated from face of register.
 - b. Opposed Blade Fusible Link: Opposed blade damper with spring closing and UL-listed fusible link for 160 F.
 4. Register and Grille Accessories:
 - a. Operating Keys: Tools designed to fit through register or grille face and operate volume control device and/or pattern adjustment.
 5. Register and Grille Finishes:
 - a. Aluminum Enamel: Air-dried aluminum enamel prime finish.
 - b. 21White Enamel: Semi-gloss white enamel prime finish.
 - c. Aluminum Anodize: Aluminum etched and anodized, covered with clear lacquer finish.
 6. Available Manufacturers: Subject to compliance with requirements, manufacturers offering registers and grilles which may be incorporated in the work include, but are not limited to, the following:
 - a. Anemostat Products Div., Dynamics Corp. of America.
 - b. E.H. Price Limited
 - c. Krueger Mfg. Co.
 - d. Metal Industries, Inc.
 - e. Titus, Div. of Philips Industries

2.15 LOUVERS

- A. General: Except as otherwise indicated, provide manufacturer's standard louvers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide louvers that have minimum free area, and maximum pressure drop for each type as listed in manufacturer's current data, complying with louver schedule.

- C. Substrate Compatibility: Provide louvers with frame and sill styles that are compatible with adjacent substrate, and that are specifically manufactured to fit into construction openings with accurate fit and adequate support, for weatherproof installation. Refer to general construction drawings and specifications for types of substrate which will contain each type of louver.
- D. Materials: Construct of aluminum extrusions, ASTM B 221, Alloy 6063-T52. Weld units or use stainless steel fasteners.
- E. Louver Screens: On inside face of exterior louvers, provide 1/2" square mesh anodized aluminum wire bird screens mounted in removable extruded aluminum frames.
- F. Dampers: Blades shall be 16 gauge galvanized steel with PVC impregnated steel blade edge seal.
- G. Available Manufacturers: Subject to compliance with requirements, manufacturers offering louvers which may be incorporated in the work include, but are not limited to, the following:
 - 1. Arrow United Industries, Inc.
 - 2. Louvers & Dampers, Inc.
 - 3. Metal Industries, Inc.
 - 4. Penn Ventilator Co., Inc.
 - 5. Ruskin Mfg. Co.
 - 6. Vent Products Co., Inc.

2.16 KITCHEN EXHAUST DUCTS

- A. General: Fabricate kitchen exhaust ducts and supports, used for smoke and vapor removal from cooking equipment, of 16 Ga. minimum galvanized steel where concealed, and of 18 Ga. minimum stainless steel where exposed. For duct construction, comply with SMACNA-06 "HVAC Duct Construction Standards, Metal and Flexible", and NFPA 96 "Ventilation Control and Fire Protection of Commercial Cooking Equipment."

PART 3 - EXECUTION

3.1 INSTALLATION OF DUCTWORK

- A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight (5% leakage) and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling.
- B. Seal ductwork, after installation, to seal class recommended, and method prescribed in SMACNA "HVAC Duct Construction Standards."
- C. Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- D. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or,

if not otherwise indicated, run ductwork in shortest route which does not obstruct usable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

- E. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- F. Where ducts pass through interior partitions and exterior walls, conceal space between construction opening and duct or duct-plus-insulation with sheet metal flanges of same gauge as duct.
- G. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- H. Support ductwork in manner complying with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" hangers and supports section.

3.2 INSTALLATION OF DUCT ACCESSORIES

- A. Install duct accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90 elbows in supply, return, and exhaust air systems, and elsewhere as indicated.
- C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work, including ductwork, as necessary to interface installation of duct accessories properly with other work.
- E. Field Quality Control: Operate installed duct accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.

3.3 INSTALLATION OF OUTLETS AND INLETS

- A. General: Install outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.
- B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of outlets and inlets with other work.

- C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.4 CLEANING AND PROTECTION

- A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.
- B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.
- C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

END OF SECTION 15840

SECTION 15910 - ELECTRIC TEMPERATURE CONTROL SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

1.2 DESCRIPTION OF WORK

- A. The work of this section provides a system of automatic temperature control and automation for the heating, ventilating and air conditioning system. This task includes control devices, instruments, and appurtenances, installed complete. This task completion must result in complete and operable heating, ventilating and air conditioning control and automation systems.

1.3 QUALITY ASSURANCE

- A. Manufacturer: A firm regularly engaged in manufacture of electric temperature control equipment, of types and sizes which are similar to required equipment, and which have been in satisfactory use for not less than 5 years, in similar service.
- B. Compliance: Standards, codes, rules and regulations listed in the Supplementary HVAC Conditions affect the work of this section.
- C. Installer: The system shall be calibrated and completely checked by competent mechanics regularly employed by the manufacturer of the temperature control equipment.
- D. Installer: A firm specializing and experienced in electric control system installations for not less than 5 years.
- E. Electrical Standards: Provide electrical products which have been tested, listed and labeled by Underwriters' Laboratories (UL) and comply with NEMA standards.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications for each control device furnished, including installation instructions and start-up instructions. Submit wiring diagram for each electrical control device.
- B. Maintenance Data: Submit maintenance data and spare parts lists for each type of control device. Include this data in maintenance manual.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Provide factory shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage and handling as required to prevent equipment damage, and to

eliminate dirt from entering equipment. Store equipment and materials inside and protected from weather.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. General: Furnish and install a complete system of automatic temperature controls. The system shall be complete in all respects including all labor, materials, equipment and services necessary and shall be installed by personnel regularly employed by the manufacturer.
- B. Warranty: The control system herein specified shall be guaranteed to be free from defects in workmanship and material under normal use and service for a period of one year from the date of completion. During the one year guarantee period, the control manufacturer shall maintain the control system and shall assist in training the Owner's representative in the proper operation and maintenance of the system, providing the Owner's representative with three copies of the control and operating and maintenance manual.
- C. Installer: All line voltage electric wiring in connection with the automatic temperature control system shall be furnished and installed by the Electrical Contractor.
- D. Installer: Provide heating cooling thermostats with automatic seasonal changeover sub-bases. Thermostats shall be multi-stage where applicable.

PART 3 - EXECUTION

3.1 INSTRUCTION AND ADJUSTMENT

- A. General: On completion of the job, the contractor shall completely adjust, ready for use, all thermostats, damper motors, and relays provided under this contract. The contractor shall provide a complete instruction manual covering the function and operation of all control components on the job. Four copies of this manual shall be furnished to the Owner's operating personnel and a competent technician shall be provided for instruction purposes.

END OF SECTION 15910

SECTION 15980 - TESTING, ADJUSTING, AND BALANCING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK

- A. Extent of testing, adjusting, and balancing work is indicated by requirements of this section, and also by drawings and schedules, and is defined to include **but** is not necessarily limited to, air distribution systems, hydronic distribution systems and associated equipment and apparatus of mechanical work. The work consists of setting speed and volume (flow) adjusting facilities provided for systems, recording data, conducting tests, preparing and submitting reports, and recommending modifications to work as required by contract documents.
- B. Component types of testing, adjusting, and balancing specified in this section includes the following as applied to mechanical equipment:
 - 1. Fans.
 - 2. Air-conditioning units.
 - 3. Ductwork systems.

1.3 QUALITY ASSURANCE

- A. Installer: A firm with at least 3 years of successful testing, adjusting, and balancing experience on projects with testing and balancing requirements similar to those required for this project, who is not Installer of system to be tested and is otherwise independent of project.
- B. Installer: A firm certified by **National** Environmental Balancing Bureau (NEBB) in those testing and balancing disciplines similar to those required for this project, who is not Installer of system to be tested and is otherwise independent of project.
- C. NEBB Compliance: Comply with **NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems"** as applicable to mechanical air hydronic distribution systems and associated equipment and apparatus.
- D. Industry Standards: Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise indicated.

1.4 SUBMITTALS

- A. Submit certified test reports signed by Test and Balance Supervisor who performed TAB work. In addition, have report certified by Professional Engineer who is familiar with TAB work and also with project, and who is registered in jurisdiction where testing is being conducted.
 - 1. Include identification and types of instruments used and their most recent calibration date with submission of final test report.
- B. Submit biographical data on Engineer who is directly supervise testing, adjusting, and balancing work.
- C. Maintenance Data: Include in maintenance manuals, copies of certified test reports.

1.5 JOB CONDITIONS

- A. Do not proceed with testing, adjusting, and balancing work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.
- B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

PART 2 - PRODUCTS

2.1 PATCHING MATERIALS

- A. Except as otherwise indicated, use same products as used by original Installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. Patching is to be completed by original Installer.
 - 1. At Tester's option, plastic plugs with retainers may be used to patch drilled holes in ductwork and housings.

2.2 TEST INSTRUMENTS

- A. Utilize test instruments and equipment for TAB work required, of type, precision, and capacity as recommended in the following TAB standards:
 - 1. NEBB's Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

PART 3 - EXECUTION**3.1 PROCEDURE, REPORTS, REPAIRS, AND RETESTING**

- A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with TAB work until unsatisfactory conditions have been corrected in manner acceptable to Tester.
- B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.
- C. Test, adjust and balance system during summer season for air conditioning systems and during winter season for heating systems, including at least period of operation at outside conditions within 5 F wet bulb temperature of maximum summer design condition, and within 10 F dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit.
- D. Prepare report of test results, including instrumentation calibration reports, in format recommended by applicable standards.
- E. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in manner recommended by original Installer.
- F. Mark equipment settings, including damper control positions, valve indicators, fan-speed-control levers, and similar controls and devices, to show final settings at completion of TAB work. Provide markings with paint or other suitable permanent identification materials.
- G. Prepare a report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced including, where necessary, modifications which exceed requirements of contract documents for mechanical work.
- H. Retest, adjust and balance systems subsequent to significant system modifications, and resubmit test results.

END OF SECTION 15980

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SECTION 16010 - GENERAL ELECTRICAL PROVISIONS**PART 1 - GENERAL****1.1 WORK INCLUDED IN THIS SECTION**

- A. Referenced Documents: Bidding Requirements, Conditions of the Contract, and Division 1 - General Requirements are hereby made a part of this section.
- B. Work included in Division 16 includes the furnishing of all labor, materials, tools, equipment, drayage, rigging, fees, permits, inspections, etc., necessary for the complete installation and operation of all electrical equipment and work as shown on the Plans and specified herein. Work includes the following general listings, in addition to which furnish all fittings, hangers, supports, conduits, sleeves, inserts and other such items and accessories required or necessary for the operation of a complete electrical system as shown on the Plans and/or specified herein:
 - 1. Lighting and outlet system, including parking and area lighting.
 - 2. Emergency lighting.
 - 3. Service entrance.
 - 4. Power wiring, feeders and panelboards.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Submittals: Division 1.
- B. Excavating and Backfilling: Division 2.
- C. Painting: Division 9.
- D. Raceways, Wires, Boxes/Fittings, and Devices: Section 16100.
- E. Panelboards: Section 16160.

1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. Work to conform to the latest editions of the following:
 - 1. National Electrical Code (NEC).
 - 2. Local electrical code.
 - 3. All other applicable city, state, and national codes.
 - 4. Power company electrical standard requirements.
 - 5. American Society for Testing and Materials (ASTM).
 - 6. National Electrical Manufacturers Association (NEMA).
 - 7. Occupational Safety and Health Administration (OSHA).
 - 8. Underwriters' Laboratories, Inc. (UL), and shall be so labeled.
 - 9. International Building Code (IBC).

1.4 QUALIFICATIONS

- A. Electrical Sub-contractor of work specified herein to have been engaged in electrical contracting business for a minimum of five (5) years experience prior to bid date and be prepared to show evidence and references if requested by the Owner.

1.5 SUBMITTALS

- A. Brochures to be submitted for the following: (See corresponding section.)
 - 1. Light fixtures.
 - 2. Panelboards, switchgear, fuses.
 - 3. Wiring devices.
 - 4. Disconnects.
 - 5. Any other item designated by the Owner.

1.6 SUBSTITUTIONS AND DEVIATIONS

- A. The intent of these specifications is to establish minimum quality standards for material and equipment installed. All materials, equipment, and apparatus shall be new and of the quality indicated in the following specifications.
- B. It is not the Architect/Engineer's intention to discriminate against any manufacturer or product. Any manufacturer desiring to submit his product for approval as an equal to that specified may do so by providing a sample specification to the Engineer's office for approval a minimum of 10 working days prior to bid date.

1.7 FEES

- A. Procure all the necessary and usual permits and certificates for all work installed. Deliver same to the Owner before final acceptance. Pay all inspection fees necessary.

1.8 SPECIAL CONDITIONS OF THE WORK

- A. Drawings are necessarily diagrammatic and do not show every connection in detail or every line conduit in its exact location.
- B. Investigate structural and finish conditions and arrange Work accordingly; furnish all fittings and accessories required to meet conditions and give satisfactory operation. Coordinate with other Sub-contractors to avoid interference with the Work.
- C. Work shall be laid out to be concealed in furred chases and suspended ceilings, etc., in finished portions of building, unless specifically noted to be exposed. Work to be installed to avoid crippling of structural members.
- D. Electrical Sub-contractor, by submitting a sub-bid, sets forth that he has the necessary technical training and ability and that he will install his Work in a satisfactory and workmanlike manner up to the best standard of the trade, complete and in good working order.

- E. If any of the requirements of the plans and specifications are impossible of performance, or if the installation will not perform satisfactorily, he shall report same to the Owner for correction during the bidding period.
- F. The right to make any reasonable change in the location of outlets, apparatus, and equipment up to time of roughing-in is reserved by the Owner without involving any additional expense to the Owner.

1.9 SITE INVESTIGATION

- A. Electrical Sub-contractor shall visit the site and ascertain the conditions to be met there in installing his Work and make due provisions for same in his bid. It will be assumed that the Electrical Sub-contractor in submitting his bid has visited the premises and that his bid covers all work necessary to properly install his Work. Failure to comply with these requirements shall not be considered justification for the omission or faulty installation of any of his Work, or for the payment of extra compensation for work covered by Specifications and Plans.
- B. Locations and elevations of utilities shown on Plans have been obtained from site utility plans, existing plans, site inspection and utility companies serving the site. The Sub-contractor shall examine the site verifying to his own satisfaction the location and elevation of all utilities and shall adequately inform himself as to their relationship to the Work before entering into a contract.
- C. Specifications and the Drawings in no way imply as to the condition of the soil to be encountered. When excavating may be required in execution of the Work, Electrical Subcontractor agrees that he has informed himself regarding conditions affecting work, labor, and materials required, without recourse to any representations as to soil conditions that may appear, or seem to be implied in any portion of the Contract documents.
- D. All Work in connection with this Contract will be under the supervision and to the entire satisfaction of the Owner or his authorized representative who shall determine all questions as to the satisfactory completion of the Work, or any part thereof, and defects necessary to be remedied.
- E. The Electrical Sub-contractor shall give his personal attention to all parts of the Work and shall employ only skilled and reliable workmen in the performance thereof. They shall also accord to the Owner the right to decide upon and discontinue the services of any workman who does not possess satisfactory skill and qualifications, or is otherwise objectionable.

1.10 SAFETY STANDARDS

- A. It shall be the responsibility of the Electrical Sub-contractor to initiate, maintain and supervise all safety precautions required by local, state and federal laws, including OSHA (Occupational Safety and Health Administration).

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials described in Division 16 to be new. Any material damaged during installation shall be replaced at Sub-contractor's expense.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Work shall be done in accordance with Plans and Specifications and shall meet rules and regulations of all governing agencies having jurisdiction.
- B. If Plans and Specifications differ from required minimum standards set forth in ordinances, ordinances shall govern unless the Plans and Specifications exceed requirements, in which case Plans and Specifications shall govern.
- C. If any disagreement between the Plans and Specifications and the ordinances occurs, attention must be called to same before signing of the Contract. After the contract has been signed, the Electrical Sub-contractor is responsible for having all Work meet with the requirements of the governing ordinances. No extra to the contract will be granted to correct any discrepancy existing between the Work and the ordinances.

3.2 GUARANTEE

- A. All electrical Work to be guaranteed for a period of one (1) year from date of acceptance by Owner.
- B. Upon notice of any electrical malfunction, the Electrical Sub-contractor shall remedy the malfunction including all materials, equipment and labor at no extra cost to the Owner.

3.3 LOCATIONS OF FIXTURES AND EQUIPMENT

- A. Fixtures and equipment shall be as shown on Plans and Elevations. Locations of fixtures or equipment not shown on Drawings shall be established or verified in writing or by shop drawings.

3.4 PARTS LISTS AND MAINTENANCE MANUALS

- A. The Electrical Sub-contractor shall submit to the Owner 30 days prior to final acceptance of the building, complete and detailed parts lists, maintenance manuals, etc., covering electrical equipment furnished under this Contract. Brochures shall include all as-built equipment shop drawings, all cuts and capacity information, names and addresses of manufacturers, stocking distributors, manufacturer's agents and/or factory representatives and shall cover all items of equipment on which submitted date is made and shall also include manuals and lists herein called for.

- B. Brochures shall be in three copies, shall be bound, indexed and tabbed referencing all items to the Plans and Specifications regarding locations of equipment and materials.

3.5 AS-BUILT DRAWINGS

- A. At the completion of this project, the Electrical Sub-contractor shall provide the Owner with a set of drawings showing all conduit, outlets, etc., installed by the Electrical Sub-contractors. These drawings shall be complete in every detail and shall incorporate all changes made during the course of the conduct of the project. These drawings shall be prepared in such a manner as to enable the Owner to properly maintain, operate, and repair both concealed and exposed Work.

3.6 PAINTING AND FINISHING

- A. Paint all equipment, metal work, conduit, hangers, rods, and etc., exposed to view and installed under this Division, with two coats of oil-base metal protective paint in colors as directed by the Owner.
- B. Refer to Division 9 for painting requirements.

3.7 LOCAL BOARDS

- A. Before submitting a bid, Electrical Sub-contractor shall familiarize himself with the rules of all governing boards having jurisdiction, and he shall notify the Owner before submitting his bid, if in his opinion, any work or material specified is contrary to such rules.
- B. The Electrical Sub-contractor shall not sublet any part of this Work unless approved by the Owner, who shall also approve the Sub-contractor. Approvals will not relieve the Electrical Sub-contractor of full responsibility.

3.8 SEPARATE CONTRACTS WITH OWNER

- A. The Owner reserves the right to let other contracts to perform related work. The Electrical Sub-contractor shall afford other contractors reasonable opportunity for the storage and introduction of materials for execution of their Work and shall properly connect and coordinate his own Work with theirs. Cooperation shall be absolute to insure harmonious relations with these other contractors that all Work may be completed efficiently.
- B. If any part of the Work depends upon Work of other Contractors for operation or results, Sub-contractor shall inspect the other Work, and shall promptly report to the Owner any condition that conflicts with his Work. Failure to do so shall constitute an acceptance as being suitable and proper as far as his own Work is concerned.

3.9 EXCAVATION AND BACKFILL

- A. Electrical Sub-contractor to provide all excavation required in execution of his Work.

- B. Excavations to be to depths indicated or required, protected and kept dry at all times, and properly backfilled, moistened and mechanically tamped to maximum compaction at completion in accordance with Division 2 - Excavating and Backfilling.
- C. Remove any surplus excavated earth from site.
- D. Arrange for and pay all costs of paving patching if excavation required in city streets.

3.10 SLEEVES

- A. Where conduit passes through partitions, walls, and floors, provide galvanized sheet metal sleeves of sizes to readily accommodate conduit.
- B. Conduit projecting through roofing to be made water-tight by proper flashing, a sheet metal cap and tightening band. Flashings to be furnished by Electrical Sub-contractor and installed by roofer.

3.11 INTERIOR CUTTING AND PATCHING

- A. Should any structural difficulties prevent installation of fixtures, equipment, running of conduit, etc., at all points shown on Drawings, then necessary minor deviations therefrom, as determined by the Owner, may be permitted and must be made without additional cost to the Owner.
- B. Any necessary cutting into partitions, walls, floors to be neatly and carefully done. No cutting into structural parts of buildings, likely to impair strength of building, to be done without approval of Owner.
- C. Electrical Sub-contractor to be held responsible for all damages caused by his Work or through the neglect of his workmen. All patching and repairing of damaged Work to be done under direction of Owner at expense of Electrical Sub-contractor.

3.12 SCAFFOLDING

- A. Furnish and erect, at Sub-contractor's expense and risk any and all appliances, scaffolding, lights, guards, temporary walks, tools, transportation, etc., required for the proper construction or protection of this Work.

3.13 CONTRACTOR'S COORDINATION AND CLEANING UP

- A. Electrical Sub-contractor shall cooperate with the other contractors on the job to the end that as a whole, the job shall be finished one of its kind, and shall carry on this Work in such a manner that none of the other contractors shall be handicapped, hindered, or delayed. When work is finished, remove from the premises all tools, machinery, debris, etc., occasioned by his Work, and leave the premises free of all obstructions and hindrances.
- B. Where electrical work occurs in masonry walls, the installation shall be done sufficiently in advance of construction; fittings, appurtenances, etc., shall be installed in such a manner and at such locations as to avoid unnecessary cutting of masonry units. Work erected in advance of masonry shall be securely supported and held in position to prevent displacement. Cutting and

fitting of masonry around properly located equipment will be done by masons. Place Work located in partitions or ceilings ahead of the construction, with equipment securely wired in place. The Contractor shall have a representative on the job during all concrete pours to insure all of his equipment is adequately supported and protected and will not be adversely affected by such operations.

- C. Cooperate with the local utility companies in such a manner that the installation of all services proceeds in an orderly manner, and meets all requirements of the specified companies involved.

3.14 TEMPORARY ELECTRIC SERVICE

- A. Arrange and pay for necessary temporary electric service connections as specified in Division 1 - General Requirements. Comply with power company requirements.

3.15 ELECTRICAL EQUIPMENT BY OTHERS

- A. Except for such items as are normally wired up at their point of manufacture and unless specifically noted to the contrary in the documents, execute all electric wiring of every character both for power supply and for pilot and control for equipment. Others will erect all motors in place ready for connection. Mount all starters and control equipment, furnishing supporting structures where necessary.

3.16 TESTING AND ADJUSTING

- A. All systems shall be tested in the presence of the Owner.
- B. All testing equipment necessary to satisfactorily conduct the required tests shall be provided and the tests to be made by the Contractor at the Contractor's expense under the direction of the Owner.
- C. All equipment furnished and installed and/or connected under the provisions of these Specifications shall be demonstrated to function electrically in the manner required.
- D. The entire electrical installation shall be free from short circuits and improper grounds. Tests shall be made at each power panel and lighting panel with all switches closed. Each power circuit shall be tested at its switch. In testing for insulation values to ground, the power equipment shall be connected for normal operation. The instruments required for these tests shall be furnished by the Sub-contractor.
- E. Insulation values shall not be less than those required by the National Electrical Code. Other specific tests shall be made in accordance with requirements stated in these Specifications.
- F. All loads shall be properly balanced on each phase of the system, within 5%.
- G. If the tests indicate unsatisfactory materials, workmanship, or performance, this Sub-contractor shall remove such defective materials and replace with new material at his own expense, shall correct defective workmanship, and shall then conduct same tests again until the satisfactory character of the work installed by him has been fully demonstrated to the satisfaction of the Owner.

3.17 PROTECTION OF UNDERGROUND CONDUIT

- A. All steel conduit run underground shall be protected by a factory applied coating or wrapping consisting of one of the following:
- B. Minnesota Mining and Manufacturing Company "Scotch Kote" Resin #202, factory applied coating with two-ply "Scotchwrap" #50 tape on field joints.
- C. PVC plastic primer, followed by poly-vinyl plastic coating as supplied by Lone Star Steel Company "Extra Coat" or approved equal. Field joints shall be wrapped in strict accordance with manufacturer's directions.
- D. Sub-contractor shall submit samples and detailed Specifications for final approval.

3.18 WORKMANSHIP

- A. Labor shall be performed in a thorough and workmanlike manner and with all reasonable rapidity to the satisfaction of the Owner.
- B. Material or equipment shall be delivered to the project in the manufacturer's original, unopened, labeled containers and be adequately protected against moisture, tampering, or damage from improper handling or storage. Materials shall not be delivered to the job before they are ready for installation.
- C. The Owner will require the removal from the premises of such material or work as in his opinion is not in accordance with the Specifications or Drawings. The Owner has authority to stop the work whenever such stoppage may be necessary to insure the proper execution of the Contract.
- D. Any item of equipment shall be the product, modified as required by the requirements of the project, of a manufacturer experienced in the design, construction, and operation of equipment for the purpose required and who shall have furnished such equipment long enough to be able to show a record of successful operation.

3.19 CLEAN-UP

- A. It is the Electrical Sub-contractor's responsibility to clean up all trash and debris caused by the work of this Division, keeping premises, street, sidewalks, and adjacent property clean and neat at all times and to dispose of such materials outside the legal limits of the project or as directed by the Owner.

3.20 SERVICE ENTRANCE

- A. All equipment used for service entrance applications shall be labeled "Service Entrance Rated".

3.21 GROUNDING

- A. Insure entire electrical system is grounded. Comply with NEC 250, Grounding. Provide service entrance ground wires and rods to insure a maximum 25 ohm resistance.

END OF SECTION 16010

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SECTION 16100 - RACEWAYS, WIRES, BOXES/FITTINGS, AND DEVICES**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to components specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of components is indicated by drawings and schedules.
- B. Types of raceways in this section include the following:
 - 1. Electrical metallic tubing.
 - 2. Flexible metal conduit.
 - 3. Intermediate metal conduit.
 - 4. Liquid-tight flexible metal conduit.
 - 5. Rigid metal conduit.
 - 6. Rigid nonmetallic conduit.
- C. Types of wire in this section include the following:
 - 1. Copper conductors.
- D. Types of electrical boxes and fittings in this section include the following:
 - 1. Outlet boxes.
 - 2. Junction boxes.
 - 3. Pull boxes.
 - 4. Conduit bodies.
 - 5. Bushings.
 - 6. Locknuts.
 - 7. Knockout closures.
- E. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles.
 - 2. Switches.
 - 3. Wall plates.
 - 4. Plugs.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of components of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: A firm or individual with not less than 3 years of successful experience in installations similar to those required for this project.
- C. Comply with applicable portions of NEMA, UL, and NEC standards pertaining to raceways, wire, boxes/fittings, and devices.
- D. Comply with FS W-C-582, "Conduit, Raceway, Metal and Fittings; Surface", pertaining to surface metal raceways.
- E. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards, ANSI/ASTM standards, and IEEE standards pertaining to materials, construction and testing of wire and cable.
- F. Comply with ANSI C 134.1 (NEMA Standards Pub No. OS 1) and FS W-C-586 as applicable to sheet-steel outlet boxes, device boxes, covers and box supports.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each item listed below.
 - 1. Receptacles.
 - 2. Switches.

PART 2 - PRODUCTS

2.1 RACEWAYS - METAL CONDUIT AND TUBING

- A. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.
- B. Rigid Steel Conduit: FS WW-C-0581 and ANSI C80.1.
- C. Intermediate Steel Conduit: FS WW-C-581.
- D. PVC Externally Coated Rigid Steel Conduit: ANSI C80.1 and NEMA Std Pub No. RN 1.
- E. Rigid Metal Conduit Fittings: FS W-F-408.
- F. Electrical Metallic Tubing (EMT): FS WW-C-563 and ANSI C80.3.
- G. PVC Externally-Coated (EMT): ANSI C80.3 and NEMA Std Pub No. RN 1.

- H. EMT Fittings: FS W-F-408.
- I. Flexible Metal Conduit: FS WW-C-566, zinc-coated steel.
- J. Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 1, Style A.
- K. Liquid-Tight Flexible Metal Conduit: Provide liquid-tight flexible metal conduit; construct of single strip, flexible, continuous, interlocked, and double-wrapped steel; galvanize inside and outside; coat with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- L. Liquid-Tight Flexible Metal Conduit Fittings: FS W-F-406, Type 1, Class 3, Style G.

2.2 RACEWAYS - NONMETALLIC CONDUIT AND DUCTS

- A. General: Provide nonmetallic conduit, ducts and fittings of types, sizes and weights (wall thicknesses) for each service indicated. Where types and grades are not indicated, provide proper selection determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for raceways.
- B. PVC Conduit and Tubing Fittings: NEMA Stds Pub No. TC 3, match to conduit/tubing type and material.
- C. Conduit and Tubing Accessories: Provide conduit and tubing accessories of types, sizes, and materials required, complying with manufacturer's published product information, which mate and match conduit and tubing.

2.3 RACEWAY APPLICATIONS

- A. General: For each electrical raceway system indicated, provide a complete assembly of conduit, tubing, or duct with fittings, including, but not necessarily limited to, connectors, nipples, couplings, compression type fittings, bushings, locknuts, other components and accessories needed to form a complete system of the type indicated.
- B. Rigid Steel and Intermediate Metal Conduit: Use rigid steel or intermediate metal conduit to run all electrical raceway systems where cast in concrete walls or floor slabs which have waterproof membranes, and where cast in masonry walls. Use compression type fittings. Conduit smaller than 1/2-inch in diameter will not be permitted.
- C. EMT: Use EMT for branch circuit electrical raceway systems where concealed in furred ceilings or in walls, exposed inside where not exposed to physical damage, or cast in concrete walls or floor slabs which do not have waterproof membranes. Use compression type couplings and fittings made-up tight for sizes up to 4 inches. Use watertight couplings and fittings where required. Where cast in concrete and floor slabs, use concrete-tight couplings and fittings and terminate conduit in a box cast in concrete, or with rigid steel conduit turn-outs from concrete. Conduit smaller than 1/2-inch in diameter will not be permitted.
- D. Flexible Metal: Use flexible metal conduit and fittings for lighting fixture connections and for other electrical equipment connections where subject to movement and vibration. Use flexible metal conduit from outlet boxes to lighting fixtures in such lengths as required, 6 feet maximum. Conduit smaller than 1/2-inch in diameter will not be permitted except that 3/8-inch

flexible metallic conduit may be used for lighting fixture "pigtailed". Use of flexible metal conduit is subject to local authorities approval.

- E. Liquid-Tight Flexible Metal: Use liquid-tight flexible metal conduit and fittings for all motor connections and for other electrical equipment connections where subject to movement and vibration, and when subject to one or more of the following conditions: exterior location; moist or humid atmosphere where condensate can be expected to accumulate; corrosive atmosphere; subject to water spray; subject to dripping oil, grease, or water. Conduit smaller than 1/2-inch in diameter will not be permitted.
- F. PVC Conduit: Use for underground and buried applications. Use wrapped steel elbows at all locations where conduit rises out of ground or through slab.

2.4 WIREWAYS

- A. General: Provide electrical raceways of types, grades, sizes, weights (wall thicknesses), number of channels, for each service indicated. Provide complete assembly of raceway including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as needed for complete system. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements, and comply with applicable portions of NEC for electrical raceways.
- B. Surface Metal Raceways: Provide surface metal raceways of sizes and channels indicated; construct of galvanized steel with snap-on covers, with 1/8" mounting screw knockouts in base approximately 8" o.c. Provide fittings indicated which match and mate with raceway. Finish with manufacturer's standard prime coating suitable for painting.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering surface metal raceways which may be incorporated in the work include, but are not limited to, the following:
 - 1. B-Line Systems, Inc.
 - 2. Wiremold Company.

2.5 WIRE AND CABLES

- A. Wire and cables must be new and of copper conductors with protective coatings as specified below or on the plans. Wire and cables must be rated 600V type. Use type THHN standard wall insulation except as noted below or specifically noted on plans. No wire smaller than No. 12 shall be used for any lighting or power services. No wire smaller than No. 16 shall be used for any control circuit. Wire No. 6 and larger shall be stranded and shall have standard wall THW. Aluminum conductors may be used for distribution feeders only, provided they have the same ampacity as that of copper specified, and that the conduit size is increased in accordance with the National Electric Code. Wire smaller than No. 6 shall be copper.

1. The following color code shall be used throughout the system:

	120/208V

Phase A:	black
Phase B:	red
Phase C:	blue
Neutral:	white

- B. Conductors and strands of conductors shall be soft drawn, annealed, copper, having a conductivity of not less than 98% of that of pure copper.
- C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering wire and cables which may be incorporated in the work include, but are not limited to, the following:
 1. Alpha Wire Co.
 2. Beldon Inc.
 3. Southwire Co.

2.6 BOXES AND FITTINGS

A. Interior Outlet Boxes:

1. General: Unless shown otherwise, provide standard manufacturer's galvanized steel box, constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices. Provide "gang" boxes where devices are shown to be grouped.
2. Type for Various Locations:
 - a. Ceilings: 4 inches square, 2-1/8 inches deep.
 - b. Plaster walls: 4 inches square, 2-1/8 inches deep with raised plaster cover, set with face approximately 1/8 inch from finished surface. Furnish shallow boxes where necessary.
 - c. Dry-wall construction walls: Standard galvanized box, 2-1/8 inches deep. Furnish shallow boxes where necessary.
 - d. Masonry walls: Galvanized boxes made especially for masonry installations; depths of boxes must be properly coordinated for each specific installation.
 - e. Surface: Type FS or FD box with surface cover.
 - f. Special: Where above types are not suitable, furnish boxes to suit use taking into account space available, appearance, and Code requirements.
3. Interior Outlet Box Accessories: Provide accessories as required for each installation, including proper covers or wall device plates, mounting bracket, wallboard hangers, extension rings, plaster rings for all boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes, compatible with outlet boxes being used and meeting requirements of individual wiring situations.

B. Weatherproof Outlet Boxes:

1. Provide hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of the type, shape and size required, with cover plate with spring-hinged weatherproof caps with gaskets.

C. Junction and Pull Boxes:

1. Provide galvanized sheet steel boxes with screw-on covers. All exterior boxes and boxed-in damp locations shall have gasketed covers.

2.7 WIRING DEVICES

A. Specification Grade Switches and Outlets:

1. Switches shall be AC quiet type Leviton Specification Grade or equal, listed by Underwriters' Laboratories Inc., and complying with current Federal Specification W-S-896. Circuit control contacts shall be silver-cadmium oxide; terminal screws and back-wiring wells shall accept up to size #10 AWG wire. Control shall be single-pole, double-pole, three-way or four-way; standard or framed toggle. Toggles shall be white; rating shall be 20 amperes, 120-277 volts alternating current, grounding.
2. Straight-blade 20-ampere 2-pole, 3-wire grounding receptacles shall be Leviton Specification Grade or equal and shall be UL Listed and comply with current Federal Specification W-C-596. Devices shall be self-grounding and shall be white.
3. Cover Plates: All cover plates to be one-piece specification grade by Leviton or equal. Plates in all areas shall be satin finish stainless steel.

B. Ground Fault Receptacles:

1. Ground fault circuit interrupters shall be Leviton GFCI 20-ampere duplex-receptacle types or equal, complying with UL Standard 943, Class A, and shall have designer-type receptacle faces, made in conformance with NEMA WD-1-1.10. All models shall have nylon faces and bodies and shall be capable of being installed to afford feed-through GFCI protection to the entire branch circuit or portions thereof, as well as through their own receptacles. In the feed-through mode, all models shall be current-rated at 20A. Devices shall be white.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install components where indicated in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.
- B. Coordinate with other work including metal and concrete work, as necessary to interface installation.
- C. Coat underfloor metal raceways with bitumastic type protective coating prior to placing concrete.
- D. Level and square raceway runs, and install at proper elevations/heights.

- E. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- F. Ground all metallic conduits in accordance with NEC.
- G. Install flexible conduit for motor connections, and for other electrical equipment connections where subject to movement and vibration.
- H. Install liquid-tight flexible conduit for connection of motors and for other electrical equipment where subject to movement and vibration, and also where subjected to one or more of the following conditions:
 - 1. Exterior location.
 - 2. Moist or humid atmosphere where condensate can be expected to accumulate.
 - 3. Corrosive atmosphere.
 - 4. Subjected to water spray.
 - 5. Subjected to dripping oil, grease, or water.
- I. Wherever possible, install horizontal raceway runs above water and steam piping.
- J. Use pulling compound or lubricant where necessary for installing wire; compound must not deteriorate conductor or insulation. Use pulling means, including fish tape, cable or rope which cannot damage raceway.
- K. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
- L. Provide knockout closures to cap unused knockout holes in boxes where blanks have been removed.
- M. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.
- N. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- O. Switches shall clear frames and corners by 4" or be centered in space occupied. Install switches 48" above finished floor.
- P. Install receptacles 16" above finished floor unless otherwise noted on Plans. Outlets above counter tops to be 6" above counter top, or as otherwise indicated on plans.
- Q. Top of floor outlet to be flush with finished floor.
- R. Upon completion of installation, inspect, and remove burrs, dirt, and construction debris.

END OF SECTION 16100

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SECTION 16160 – PANELBOARDS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to panelboards specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of panelboard work is indicated by drawings and schedules.
- B. Types of panelboards in this section include the following:
 - 1. 120/240 VAC, three-phase.
 - 2. 277/480 VAC, three-phase.
- C. Refer to other Division-16 sections for cable/wire and connector work required in conjunction with panelboards - not work of this section.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of panelboards, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: Qualified with at least 5 years of successful installation experience on projects with electrical installation work similar to that required for project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction and installation of panelboards.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub Nos. AB 1 and PB 1 pertaining to panelboards and circuit breakers.
- E. UL Compliance: Comply with applicable requirements of UL 67 pertaining to panelboards.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on panelboards, including catalog cuts, time-current trip characteristic curves, and mounting requirements.
- B. Shop Drawings: Submit layout drawings of panelboards, with layouts of circuit breakers, including spatial relationships to adjacent electrical equipment.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Panelboards and Panelboard Circuit Breakers:
 - a. Eaton Corp.
 - b. General Electric Co.
 - c. ITE-Siemens Energy and Automation, Inc.
 - d. Square D Co.

2.2 PANELBOARDS

- A. General: Except as otherwise indicated, provide panelboards and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.
- B. Panelboard Bus Assembly: Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type. Single-phase, three-wire panelboard bussing shall be such that any two adjacent single pole breakers are connected to opposite polarities in such a manner that two pole breakers can be installed in any location. 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 or three pole breakers can be installed at any location. All current carrying parts of the bus assembly shall be plated. Mains ratings shall be as shown in the panelboard schedule or on the plans.
- C. Wiring Terminals: Terminals for feeder conductors to the panelboard mains and neutral shall be UL listed as suitable for the type of conductor specified. Terminals for branch circuit wiring, both breaker and neutral, shall be UL listed as suitable for the type of conductor specified.
- D. Cabinets and Fronts: The panelboard bus assembly shall be enclosed in a steel cabinet. The size of the wiring gutters and gauge of steel shall be in accordance with NEMA Standards Publication No. PB1-1977 and UL Standard No. 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel.
- E. Fronts shall include doors and have flush, cylinder tumbler-type locks with catches and spring-loaded stainless steel door pulls. The flush lock shall not protrude beyond the front of the door. All panelboard locks shall be keyed alike. Fronts shall have adjustable indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. 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 at least 1/4" high x 3" long (2" for column width) or equivalent for each circuit. Fronts shall be of code gauge steel.
- F. Integrated Equipment Short Circuit Rating: Each panelboard, as a complete unit, shall have a short circuit current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans but in no case shall be less than 10,000 Amperes RMS Symmetrical for 240VAC rated panelboards. This rating shall be established by testing with the

over-current devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

- G. UL Listing: Panelboards shall be listed by Underwriters Laboratories and bear the UL label. Panelboards shall be Square D type NQO for 120/240 VAC or equal. Panelboards shall be Square D type NF or I-Line for 277/480 VAC or equal.
- H. Service Entrance: Panelboards used for service entrance equipment must carry the "Service Entrance Equipment" label.

2.3 CIRCUIT BREAKERS

- A. General: Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, and as required for a complete installation.
- B. Molded-Case Circuit Breakers: Provide factory-assembled, molded-case circuit breakers rated as shown on plans. Provide bolt-on breakers with permanent thermal and instantaneous magnetic trips in each pole, and with fault-current limiting protection, ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 C. Provide with mechanical screw type removable connector lugs, AL/CU rated.

PART 3 - EXECUTION

3.1 INSTALLATION OF PANELBOARDS

- A. Install panelboards as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of panelboards.
- B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of panelboards with other work.
- C. Fasten circuit breakers without mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cables.
- D. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.

3.2 ADJUST AND CLEAN

- A. Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

3.3 FIELD QUALITY CONTROL

- A. Prior to energization of panelboards, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 16160

SECTION 16170 - MOTOR AND CIRCUIT DISCONNECTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to motor and circuit disconnect switches specified herein.

1.2 DESCRIPTION OF WORK

- A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedules.
- B. Types of motor and circuit disconnect switches in this section include the following:
 - 1. Equipment disconnects.
 - 2. Appliance disconnects.
 - 3. Motor-circuit disconnects.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacturer of motor and circuit disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical installation work similar to that required for project.
- C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical motor and circuit disconnect switches.
- D. UL Compliance and Labeling: Provide motor and circuit disconnect switches which have been UL-listed and labeled.
- E. NEMA Compliance: Comply with applicable requirements of NEMA Stds Pub No. KS 1.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of motor and circuit disconnect switch required.

PART 2 - PRODUCTS**2.1 ACCEPTABLE MANUFACTURERS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
1. Eaton Corp.
 2. General Electric Co.
 3. Siemens Energy and Automation, Inc.
 4. Square D Company

2.2 FABRICATED SWITCHES

- A. General-Duty Safety Switches: Provide surface-mounted, general-duty type, sheet-steel enclosed switches, of types, sizes, and electrical characteristics indicated; rated 240 volts, size and poles as indicated; horsepower rated; incorporating spring assisted, quick-make, quick-break switches which are so constructed that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose position is easily recognizable, and is capable of being padlocked in OFF position; switches shall have defeatable door interlocks that prevent the switch from being turned ON when the door is open as well as prevent the door from being opened when the switch is ON. Construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and stamped enclosure knockouts. Provide NEMA type enclosure as shown on plans.
- B. Heavy-Duty Safety Switches: Provide surface-mounted, heavy-duty type, sheet-steel enclosed safety switches, of types, sizes and electrical characteristics indicated; fusible type, rated 600 volts, size and poles as indicated; horsepower rated; incorporating quick-make, quick-break type switches; so construct that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose position is easily recognizable, and is padlockable in OFF position; switches shall have defeatable door interlocks that prevent the switch from being turned ON when the door is open as well as prevent the door from being opened when the switch is ON. Construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and positive pressure type reinforced fuse clips. Provide NEMA type enclosure as indicated on plans.
1. Fuses: Provide fuses for safety switches, as recommended by switch manufacturer, of classes, types, and ratings needed to fulfill electrical requirements for service indicated.
 - a. Class RK1 Fuses: Provide NEMA Class RK1 fuses in current ratings indicated for service entrances and elsewhere as shown. Fuses shall be Bussmann type LPS RK1 or LPN RK1.
 - b. Class RK5 Fuses: Provide dual element Class RK5 fuses with time delay of 10 seconds at 500% of rating for use with fabricated switches. Fuses shall be Bussmann FRN-R, FRS-R, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

- A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Coordinate motor and circuit disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.
- C. Install disconnect switches used with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.

END OF SECTION 16170

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SECTION 16452 - GROUNDING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work of this section.

1.2 DESCRIPTION OF WORK

- A. Extent of grounding work is indicated by drawings and schedules.
- B. Types of grounding in this section include the following:
 - 1. Grounding:
 - a. Metal building frames.
 - b. Grounding rods.
 - c. Enclosures.
 - d. Equipment.

1.3 QUALITY ASSURANCE

- A. Installer: Qualified with at least 3 years of successful installation experience on projects with electrical grounding and ground-fault protection work similar to that required for project.
- B. NEC Compliance: Comply with NEC as applicable to electrical grounding systems.
- C. ANSI/IEEE Compliance: Comply with C114.1 (IEEE Std 142) and IEEE Stds Nos. 241 and 242 pertaining to grounding of power systems.
- D. ANSI/UL Compliance: Comply with requirements of ANSI/UL and UL standards pertaining to grounding equipment and devices. Provide products which have been UL-listed and labeled.

PART 2 - PRODUCTS

2.1 GROUNDING

- A. Materials and Components:
 - 1. General: Except as otherwise indicated, provide each electrical grounding system indicated, with assembly of materials including, but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete

installation. Where more than one type meets indicated requirements, selection is Installer's option. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

2. General: Provide conduit, tube, duct and fittings complying with Division-16 Basic Materials and Methods section, "Raceways", in accordance with the following listing:
 - a. Rigid steel conduit.
 - b. PVC externally-coated rigid steel conduit.
 - c. Electrical metallic tubing.
 - d. PVC externally-coated electrical metallic tubing.
 - e. Flexible metal conduit, Type 2.
 - f. Liquid-tight flexible metal conduit.
 - g. Rigid metal conduit fittings.
 - h. EMT fittings, Type 1.
 - i. Flexible metal conduit fittings.
 - j. Liquid-tight flexible metal conduit fittings.

B. Electrical Bonding Jumpers:

1. Bonding Jumper Braid: Copper braided tape, constructed of 30-gage bare copper wires and properly sized for indicated applications.
2. Flexible Jumper Strap: Flexible flat conductor, 480 strands of 30-gage bare copper wire; 3/4" wide, 9-1/2" long; 48,250 CM. Protect braid with copper bolt hole ends with holes sized for 3/8" dia. bolts.

C. Electrical Grounding Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC.

D. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for indicated applications.

E. Ground Rods and Plates:

1. Ground Rods: Steel with copper welded exterior, 3/4" dia. x 10'.
2. Ground Plates: Sheet copper plate, 20-gage x 36" x 36", with 2 cable attachments for 1/0 or 2/0 cables.
3. Electrical Grounding Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing, solder, soldering flux, bonding straps, as recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS

- A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding complies with requirements. Comply with requirements of NEC, NESC, and NEMA standards for installation of grounding systems.

- B. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

END OF SECTION 16452

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SECTION 16510 - INTERIOR BUILDING LIGHTING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of interior lighting fixture work is indicated by drawings and schedules.
- B. Types of interior lighting fixtures in this section include the following:
 - 1. LED.
- C. Applications of interior lighting fixtures required for project include the following:
 - 1. General lighting.
 - 2. Emergency lighting.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of interior lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with interior lighting fixture work similar to that required for project.
- C. NEC Compliance: Comply with NEC as applicable to installation and construction of interior building lighting fixtures.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std Pub Nos. LE 1 and LE 2 pertaining to lighting equipment.
- E. ANSI/IES Compliance: Comply with ANSI 132.1 pertaining to interior lighting fixtures.
- F. ANSI/UL Compliance: Comply with ANSI/UL standards pertaining to interior lighting fixtures for hazardous locations.
- G. UL Compliance: Provide interior lighting fixtures which have been UL-listed and labeled.
- H. IESNA: Comply with LM-79 and LM-80 photometrics and testing standards for all LED Lighting Fixtures.

- I. IESNA: Comply with LM-79 and LM-80 photometrics and testing standards for all LED Lighting Fixtures.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on interior building lighting fixtures.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, provide product or equivalent manufacturer listed on drawings.

2.2 INTERIOR LIGHTING FIXTURES

- A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not necessarily limited to, housings, LEDs, reflectors, drivers, and wiring.
- B. Drivers: Provide LED drivers with low EMI, low-noise features; sound-rated A, and with internal thermal protection. Multi-volt operation and 0-10V dimming shall be standard.

PART 3 - EXECUTION

3.1 INSTALLATION OF INTERIOR LIGHTING FIXTURES

- A. Install interior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements. Coordinate with other electrical work as appropriate to properly interface installation of interior lighting fixtures with other work.
- B. Fasten fixtures securely to indicated structural support; and check to ensure that solid pendant fixtures are plumb.

3.2 ADJUST AND CLEAN

- A. Clean interior lighting fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

- A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with

requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

- B. Replace defective LED boards and drivers for a period of one year following the time of Substantial Completion.
- C. At the time of Substantial Completion, replace LED boards and drivers in interior lighting fixture which are observed to be non-operational after Contractor's use and testing, as judged by Architect/Engineer.

3.4 GROUNDING

- A. Provide tight equipment grounding connections for each interior lighting fixture installation where indicated.

END OF SECTION 16510

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SECTION 16520 - EXTERIOR BUILDING LIGHTING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of exterior lighting fixture work is indicated by drawings and schedules.
- B. Types of exterior lighting fixtures in this section include the following:
 - 1. LED.
- C. Applications of exterior lighting fixtures required for project include the following:
 - 1. Outdoor area lighting.
 - 2. Outdoor flood lighting.

1.3 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of exterior lighting fixtures of types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with exterior lighting fixture work similar to that required for project.
- C. NEC Compliance: Comply with NEC as applicable to installation and construction of exterior building lighting fixtures.
- D. NEMA Compliance: Comply with applicable requirements of NEMA Std. Pub. Nos. FA 1, LE 1, and LE 2 pertaining to lighting equipment.
- E. ANSI and ANSI/IES: Comply with applicable requirements of ANSI and ANSI/IES standards pertaining to exterior lighting fixtures and components.
- F. UL Compliance: Provide exterior lighting fixtures which are UL-listed and labeled.
- G. IESNA: Comply with LM-79 and LM-80 photometrics and testing standards for all LED Lighting Fixtures

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's data on exterior lighting fixtures.
- B. Shop Drawings: Submit dimensioned drawings of exterior lighting fixtures, including but not necessarily limited to, layout space relationship to associated panelboards, and connections to panelboards. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
 - 1. Exterior Lighting Fixtures:
 - a. Lithonia Lighting

2.2 EXTERIOR LIGHTING FIXTURES

- A. General: Provide lighting fixtures, of sizes, types and ratings indicated; complete with, but not necessarily limited to, housings, LEDs, reflectors, drivers, and wiring.
- B. Drivers: Provide LED drivers with low EMI, low-noise features; sound-rated A, and with internal thermal protection. Multi-volt operation and 0-10V dimming shall be standard.

PART 3 - EXECUTION

3.1 INSTALLATION OF EXTERIOR LIGHTING FIXTURES

- A. Install exterior lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation," NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Coordinate with other electrical work as appropriate to properly interface installation of exterior lighting fixtures with other work.
- C. Fasten fixtures securely to indicated structural supports; and check to ensure that solid pendant fixtures are plumb.

3.2 ADJUST AND CLEAN

- A. Clean exterior lighting fixtures of dirt and debris upon completion of installation.
- B. Protect installed fixtures from damage during remainder of construction period.

3.3 FIELD QUALITY CONTROL

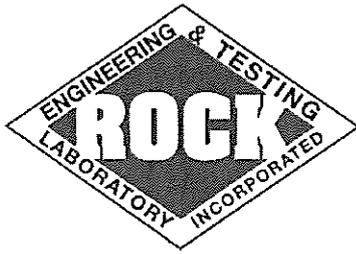
- A. Upon completion of installation of exterior lighting fixtures, and after energizing branch supply circuitry, apply electrical energy to lighting fixtures to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- B. Refer to Division-1 sections for replacement/restoration of exterior lighting fixtures, where used for temporary lighting prior to time of Substantial Completion.

3.4 GROUNDING

- A. Provide tight equipment grounding connections for each exterior lighting fixture installation where indicated.

END OF SECTION 16520

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- GEOTECHNICAL ENGINEERING
- CONSTRUCTION MATERIALS ENGINEERING & TESTING
- SOILS • ASPHALT • CONCRETE

May 18, 2016

Peter W. Lewis Architect + Associates, PLLC
334 West Water Street
Kerrville, Texas 78028

Attention: Peter W. Lewis, AIA

**SUBJECT: SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM
AND FOUNDATION RECOMMENDATIONS
FOR THE PROPOSED FIELDHOUSE
CITY OF KERRVILLE ATHLETIC COMPLEX
KERRVILLE, TEXAS
RETL Project No.: G216136**

Dear Mr. Lewis,

In accordance with our agreement, we have conducted a subsurface exploration and foundation evaluation for the above referenced project. The results of this exploration, together with our recommendations, are to be found in the accompanying report, an electronic copy of which is being transmitted herewith. RETL will provide up to two (2) versions of this report in hard copy at the request of the client.

Often, because of design and construction details that occur on a project, questions arise concerning soil conditions, and Rock Engineering and Testing Laboratory, Inc. (RETL), would be pleased to continue its role as the Geotechnical Engineer during project implementation.

RETL also has great interest in providing materials testing and special inspection services during the construction phase of this project. If you will advise us of the appropriate time to discuss these engineering services, we will be pleased to meet with you at your convenience.

Sincerely,

A handwritten signature in black ink, appearing to read "Kyle D. Hammock".

Kyle D. Hammock, P.E.
Vice President - San Antonio

ROCK ENGINEERING & TESTING LABORATORY, INC.
10856 VANDALE STREET • SAN ANTONIO, TEXAS, 78216
OFFICE: (210) 495-8000 • FAX: (210) 495-8015 • www.rocktesting.com

**SUBSURFACE EXPLORATION, LABORATORY TESTING PROGRAM,
AND FOUNDATION RECOMMENDATIONS
FOR THE PROPOSED FIELDHOUSE
CITY OF KERRVILLE ATHLETIC COMPLEX
KERRVILLE, TEXAS**

RETL PROJECT NUMBER: G216136

PREPARED FOR:

**PETER W. LEWIS ARCHITECT + ASSOCIATES, PLLC
334 WEST WATER STREET
KERRVILLE, TEXAS 78028**

MAY 18, 2016

PREPARED BY:

**ROCK ENGINEERING AND TESTING LABORATORY, INC.
10856 VANDALE STREET
SAN ANTONIO, TEXAS 78216
PHONE: (210) 495-8000; FAX: (210) 495-8015**

**TEXAS BOARD OF PROFESSIONAL ENGINEERS
FIRM REGISTRATION NUMBER 2101**



**Kyle D. Hammock, P.E.
Vice President - San Antonio**



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INTRODUCTION

This report presents the results of a soils exploration and foundation and pavement evaluation for the proposed City of Kerrville Athletic Complex Fieldhouse to be constructed in Kerrville, Texas. This study was conducted for Peter Lewis Architect + Associates, PLLC.

Authorization

The work for this project was performed in accordance with RETL Proposal Number P072015BR1 dated February 25, 2016. The proposal contained a scope of work, lump sum fee and limitations. The proposal was executed on March 4, 2016 and was returned to RETL via mail.

Purpose and Scope

The purpose of this exploration was to evaluate the soil and groundwater conditions at the site and to provide foundation recommendations suitable for the proposed project.

The scope of the exploration and evaluation included the subsurface exploration, field and laboratory testing, engineering analysis and evaluation of the subsurface soils, provision of foundation recommendations, and preparation of this report.

The scope of services did not include an environmental assessment. Any statements in this report, or on the boring logs, regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of the client.

General

The exploration and analysis of the subsurface conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for the foundation design. The recommendations submitted for the proposed project are based on the available soil information and the preliminary design details provided by Peter W. Lewis Architect + Associates, PLLC. If the structural engineer requires additional soil parameters to complete the foundation design, RETL will provide the requested information as a supplement to this report.

The Geotechnical Engineer states that the findings, recommendations, specifications or professional advice contained herein, have been presented after being prepared in a manner consistent with the level of care and skill ordinarily exercised by reputable members of the Geotechnical Engineer's profession practicing contemporaneously under similar conditions in the locality of the project. RETL operates in general accordance with "*Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction*", (ASTM D3740). No other representations are expressed or implied, and no warranty or guarantee is included or intended.

This report has been prepared for the exclusive use of Peter W. Lewis Architects + Associates, PLLC for the specific application towards the proposed City of Kerrville Athletic Complex Fieldhouse to be constructed in Kerrville, Texas.

FIELD EXPLORATION

Scope

The field exploration completed in order to evaluate the engineering characteristics of the foundation material included reconnaissance of the project site, drilling the test borings, and recovering disturbed split spoon and relatively undisturbed Shelby tube samples.

Three (3) test borings were performed at the site and were drilled to a depth of 20-feet below the existing ground surfaces. RETL determined the number, location and the depth of the borings and marked the borings in the field with the assistance of J3 Construction. RETL performed the boring operations. Upon completion of the drilling operations and obtaining the groundwater observations, the bore holes were backfilled with excavated soil and rock.

A Boring Location Plan, which is a reproduction of a drawing provided to RETL by Peter W. Lewis Architects + Associates, PLLC is included in the Appendix of this report.

Drilling and Sampling Procedures

The borings were performed using a drilling rig equipped with a rotary head and solid stem auger drilling methods were used to advance the boreholes to their desired termination depths. Disturbed samples were obtained employing split-barrel sampling procedures in general accordance with the procedures for "*Penetration Test and Split-Barrel Sampling of Soils*" (ASTM D1586). Relatively undisturbed soil samples were obtained using thin-wall tube sampling procedures in accordance with the procedures for "*Thin Walled Tube Sampling of Soils*" (ASTM D1587). The samples were classified in the field, placed in plastic bags, marked according to their boring number, depth and any other pertinent field data, stored in special containers and delivered to the laboratory for testing.

Field Tests and Measurements

Penetration Tests - During the sampling procedures, standard penetration tests (SPT) were performed to obtain the standard penetration value of the soil. The standard penetration value (N) is defined as the number of blows of a 140-pound hammer falling 30 inches required to advance the split-barrel sampler 1-foot into the soil. The sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer.

The number of blows is recorded for each of three successive 6-inch penetrations. The "N" value is obtained by adding the second and third 6-inch increment number of blows. The results of standard penetration tests indicate the relative density of cohesionless soils and comparative consistency of cohesive soils, thereby providing a basis for estimating the relative strength and compressibility of the soil profile components.

Water Level Observations - Water level observations were obtained during the test boring operations and are noted on the boring logs provided in the Appendix. The amount of water in open boreholes largely depends on the permeability of the soils encountered at the boring locations. In relatively pervious soils, such as sandy soils, the indicated depths are usually reliable groundwater levels. In relatively impervious soils, a suitable estimate of the groundwater depth may not be possible, even after several days of observation. Seasonal variations, temperature, land-use, proximity to a body of water, and recent rainfall conditions may influence the depth to the groundwater.

Ground Surface Elevations - Ground surface elevations were not provided at the boring locations. All depths referred to in this report are reported from the actual ground surface elevation at the boring locations during the time of our field investigation.

LABORATORY TESTING PROGRAM

In addition to the field investigation, a laboratory-testing program was conducted to determine additional pertinent engineering characteristics of the subsurface materials necessary in analyzing the behavior of the foundation system for the proposed structure.

The laboratory-testing program included supplementary visual classification (ASTM D2487) and water content tests (ASTM D2216) on all samples. In addition, selected samples were subjected to Atterberg limits tests (ASTM D4318), percent material finer than the #200 sieve, and one dimensional swell tests (ASTM D4546). Estimated soil strengths were obtained using a hand penetrometer.

All phases of the laboratory-testing program were conducted in general accordance with applicable ASTM Specifications. The results of these tests are to be found on the accompanying boring logs provided in the Appendix.

SUBSURFACE CONDITIONS

General

The types of foundation bearing materials encountered in the test borings have been visually classified and are described in detail on the boring logs. The results of the standard penetration tests, strength tests, water level observations and laboratory tests are presented on the boring logs in numerical form. Representative samples of the soils were placed in polyethylene bags and are now stored in the laboratory for further analysis, if desired. Unless notified to the contrary, all samples will be disposed of three months after issuance of this report.

The stratification of the soil, as shown on the boring logs, represents the soil conditions at the actual boring locations. Variations may occur between or beyond the boring locations. Lines of demarcation represent the approximate boundary between different soil types, but the transition may be gradual, or not clearly defined.

It should be noted that, whereby the test borings were drilled and sampled by experienced technicians, it is sometimes difficult to record changes in stratification within narrow limits. In the absence of foreign substances, it is also difficult to distinguish between discolored soils and clean soil fill.

Soil Conditions

The subsurface conditions encountered at the project site have been summarized and soil properties including classification, strength, plasticity, and grain size are provided in the following table:

SOIL SUMMARY TABLE								
D	Description	LL	PI	C	θ	γ_e	-#200	N and P
0-8	Lean Fat/ CLAY	36-55	21-40	1,500	0	120	68-91	N= 9-29 P= 3.5-4.5
8-20	Silty Clayey SAND	19	5	2,500	0	115	40	N= 11-39

- Where:
- D = Depth in feet below existing grade
 - LL = Liquid Limit (%)
 - PI = Plasticity Index
 - C = Average Soil Cohesion, psf (undrained)
 - θ = Angle of Internal Friction, deg. (undrained)
 - γ_e = Effective Soil Unit Weight, pcf
 - #200 = Percent Material Finer than a #200 Sieve
 - N = Standard penetration value range, blows per foot
 - P = Pocket Penetrometer Value range, tsf

Detailed descriptions of the soil encountered at the boring locations are provided on the boring logs included in the Appendix.

Seismic Site Class

The field investigation did not include a 100-foot deep soil boring, therefore, the soil properties are not known in sufficient detail to determine the Site Class per IBC. This site has stiff to hard clay and clayey sand soils extending to the 20-foot depth. Table 1615.1.1-Site Class Definitions, indicates that Site Class D materials should have soil undrained shear strengths between 1,000 and 2,000 psf and standard penetration resistances between 15 and 50 blows per foot. The on-site materials extending to a depth of 30-feet have strengths similar to Site Class D materials; therefore, RETL recommends that Site Class D, "stiff soil profile" be assumed.

Groundwater Observations

Groundwater was not encountered in the borings during the drilling operations nor measured in the borings upon completion of the drilling operations. It should be noted that the water level in an open borehole may require several hours to several days to stabilize depending on the permeability of the soils and that groundwater levels at this site may be subject to seasonal conditions, recent rainfall, drought or temperature effects.

FOUNDATION RECOMMENDATIONS

Project Description

Based on the information provided, it is understood that the proposed project will consist of the construction of a 32,853 SF fieldhouse. The structure will be a pre-engineered metal building supported by a slab-on-grade type foundation. Anticipated loads were not provided, however, based on our experience with similar types of structures, maximum concentrated loads on the order of 75 kips are expected, with wall loads in the range of ½ to 1 ½-kips per linear foot.

PVR Discussion

The clay soils located within the active zone at this site are moderate to high in plasticity. **The maximum calculated total potential vertical rise (PVR) for slab-on-grade type construction is approximately 2-inches.** The PVR was calculated using the Texas Department of Transportation Method TEX-124E and into account the depth of active zone, estimated to extend to a depth of approximately 8-feet, and the Atterberg limits test results of the soils encountered within the active zone.

The estimated PVR value provided is based on a slab-on-grade system applying a sustained surcharge load of approximately 1.0 pound per square inch on the subgrade soils. The value represents the vertical rise that can be experienced by dry subsoils if they are subjected to conditions that allow them to become saturated, such as poor drainage. Using dry soil conditions to calculate the PVR is generally considered the worst-case scenario.

The actual movement of the subsoils is dependent upon their change in moisture content. Differential vertical movements can potentially be equal to the expected total movements. Differential vertical movements associated with the soils at this site may occur over a distance of 8-feet, or approximately the depth of the active zone, within the footprint of a slab-on-grade.

Undercutting a portion of the clay subgrade soils and providing properly compacted non-expansive select fill soils below the floor slab can reduce the PVR. **Based on our calculations, the expansive clay soils will need to be undercut to a minimum depth of 2 and 3½-feet and the excavation replaced with select fill to reduce the PVR to approximately 1½ and 1-inch, respectively.**

Slab-on-Grade Recommendations

The proposed structure can utilize a stiffened slab-on-grade foundation at this site. Interior and exterior grade beams and footings may be founded on the natural soils or in properly compacted select fill soils at a minimum depth of 2-feet below the finished floor slab elevation. The exterior grade beams and footings should also penetrate a minimum of 2-feet below the final exterior grades. Interior and exterior grade beams and footings can be designed for a net allowable unit soil bearing pressure of **2,000 psf**. The net allowable unit soil bearing pressure provided utilizes a safety factor of at least 3.

The beams should be a minimum of 12-inches wide to reduce the potential for localized shear failure and the beams should be spaced a maximum of 20-feet apart, in both directions. The Structural Engineer may vary beam depths and spacing based experience designing and constructing similar type structures on sites with similar subsurface soil conditions.

The **"Design of Slab-On-Ground Foundations"** published by the Wire Reinforcement Institute, Inc. (Aug., 1981) utilizes the design criteria provided in the table below for design of a stiffened slab-on-grade foundation with a PVR value of approximately 1½ and 1-inch:

WRI DESIGN CRITERIA		
PVR Condition (in)	+/- 1½	+/- 1
Minimum Undercut Depth and Select Fill Thickness (ft)	2	3½
Climatic Rating (Cw)	16	16
Effective Plasticity Index	27	24
Soil/Climatic Rating Factor (1-C)	0.14	0.10
Maximum Beam Spacing (ft)	17	20

Soil supported floor slabs are subject to vertical movements, as discussed earlier in this report. Even slight differential movements may cause distress to interior wall partitions and rigid exterior facades supported by a shallow slab-on-grade foundation resulting in cosmetic damage. This amount of movement should be understood and addressed during the design phase of the proposed structure planned for construction at this site.

Utilities which project through slab-on-grade floors should be designed with either some degree of flexibility, or with sleeves, in order to prevent damage to these lines should movement occur.

The foundation excavations should be observed by a representative of RETL prior to steel or concrete placement to assess that the foundation materials are capable of supporting the design loads and to identify the acceptability of the native soils or select fill materials under the beams and footings. Soft or loose zones of soil or fill encountered at the bottom of the beam or footing excavations should be removed to the level of competent materials as directed by the Geotechnical Engineer. Cavities formed as a result of excavation of soft or loose zones should be backfilled with properly compacted select fill.

After opening, beam and footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the beam and footing bottoms to wetting and drying. Surface run-off water should be drained away from the excavations and not be allowed to pond. If it is required that beam and footing excavations be left open an extended period, they should be protected to reduce evaporation or entry of moisture.

SITE IMPROVEMENT METHODS

General Considerations

A majority of foundation related problems in the project area are attributable, at least in part, to poor drainage. Cohesive soils expand or shrink by absorbing or losing water. Reducing a soil's variation in moisture content will reduce its variation in volume.

A number of measures may be used to attain a reduction in subsoil moisture content variations, thus reducing the soil's volume change potential. Some of these measures are outlined below:

- During construction, a positive drainage scheme should be implemented to prevent ponding of water on the subgrade materials.
- Positive drainage should be maintained around the structure through a roof/gutter system connected to piping or directed to paved surfaces, transmitting water at least 10-feet away from the foundation perimeter. In addition, positive grades sloping away from the foundation should be designed and implemented. We recommend that others devise an effective site drainage plan prior to commencement of construction to provide positive drainage away from the foundation perimeter and off the site, both during, and after construction.

- The top 2-feet of utility trenches should be backfilled with low plasticity clays to assure the trenches do not serve as aqueducts that could transport water beneath the structure due to excessive surface water infiltration.
- Vegetation placed in landscape beds that are adjacent to the structure should be limited to plants and shrubs that will not exceed a mature height of 3-feet. Large bushes and trees should be planted away from any slab foundations at a distance that will exceed their full mature height and canopy width.

All project features beyond the scope of those discussed above should be planned and designed similarly to attain a region of relatively uniform moisture content within the foundation areas and prevent ponding of water within 10-feet of the foundation perimeters. Poor drainage schemes are generally the primary cause of foundation problems on clayey soils.

Concrete Flatwork Construction Considerations

Concrete site flatwork such as sidewalks, aprons, patios, etc. will be subject to PVR movements when constructed over the plastic soils encountered at this site. Changes in the moisture content of the supporting highly plastic soils causes volumetric changes, resulting in differential movements of the flatwork. PVR movements were discussed in the "**PVR Discussion**" section of this report. RETL recommends that the design team in conjunction with the owner, determine the acceptable PVR condition for concrete flatwork construction at this site.

CONSTRUCTION CONSIDERATIONS

Site Preparation

All vegetation, roots and objectionable materials located on the surface of the site should be initially stripped and discarded. Upon completion of the stripping, the subgrade soils in the building area should be undercut to a depth equal to 3½-feet below the existing site grades to a distance of 5-feet beyond the foundation perimeter if a PVR of 1-inch is desired.

Prior to compaction, the exposed subgrade in the building area should be proof-rolled with a minimum 20-ton rubber tired vehicle under the supervision of RETL. If any soft or loose areas are identified, the soils should be removed and replaced with compacted select fill.

The upper 6-inches of exposed subgrade soil in the building area should then be moisture conditioned and compacted to at least 95-percent of the standard Proctor (ASTM D698) maximum dry density with a moisture content within -1 to 3-percent of the optimum moisture content.

Upon completion of the subgrade preparation, a minimum of 3½-feet of compacted select fill soils should be placed to construct the building pad if a PVR of 1-inch is desired. If a PVR of 1½-inch is acceptable the undercut and replacement depth may be reduced to 2-feet. Any additional fill used to achieve the final building pad elevation should also be select fill. The select fill building pad should extend a minimum of 5-feet outside the perimeter of the proposed structure (building and any appurtenances including sidewalks, ramps and stoops constructed adjacent to the building). Excavation of beams, footings and utility trenches may proceed after placement of select fill is complete.

Select Fill

Imported select fill material used at this site should have a maximum liquid limit of 40-percent and a maximum plasticity index (PI) between 5 and 18. The select fill should be placed in no greater than 8-inch thick loose lifts and shall be compacted to a minimum density of 95-percent of the maximum dry density as determined by the standard Proctor (ASTM D698) and within -1 to +3-percent of the optimum moisture content.

Earthwork and Foundation Acceptance

Exposure to the environment may weaken the soils at the foundation bearing level if excavations remain open for long periods of time. Therefore, it is recommended that the foundation excavations be extended to final grade and that the foundation be constructed as soon as possible to minimize potential damage to the bearing soils. The foundation bearing level should be free of loose soil, ponded water, objectionable fill materials or debris and should be observed prior to concreting by the Geotechnical Engineer, or his designated representative.

Foundation concrete should not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusion, or by desiccation, the unsuitable soils must be removed from the foundation excavation and be replaced with properly compacted select fill prior to placement of concrete.

The Geotechnical Engineer, or his designated representative, should monitor subgrade preparation and placement of select fill. As a guideline, a minimum of one in-place density test should be performed on the subgrade soils and each subsequent lift of select fill for each 3,000 SF of slab area, or a minimum of 3 in-place density tests per testing interval, whichever is greater. Any areas not meeting the required compaction should be recompacted and retested until compliance is met.

Vapor Retarder

A vapor retarder with a permeance of less than 0.3 US perms (ASTM E96) should be placed under the concrete floor slab on the ground to reduce the transmission of water vapor from the supporting soil through the concrete slab and to function as a slip sheet to reduce subgrade drag friction.

Polyethylene film with a minimum thickness of 10 mils (0.25 mm) is typically used for reduced vapor transmission and durability during and after its installation. The vapor retarder should be installed according to the ASTM E1643, "*Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.*"

All penetrations through the vapor retarder should be sealed to ensure its integrity. The vapor retarder should be taped around all openings to ensure the effectiveness of the barrier. Grade stakes should not be driven through the barrier and care should be taken to avoid punctures during reinforcement and concrete placement. Placement of slab concrete directly on the vapor retarder increases the risks of surface dusting, blistering and slab curling making good concrete practice critical. A low water to cement ratio concrete mix design combined with proper and adequate curing procedures will help ensure a good quality slab.

Expansion/Control Joints

Expansion and or control joints should be designed and placed in various portions of the structure, especially rigid brick or rock walls. Properly planned placement of these joints will assist in controlling the degree and location of material cracking that normally occurs due to material shrinkage, thermal affects, soil movements and other related structural conditions.

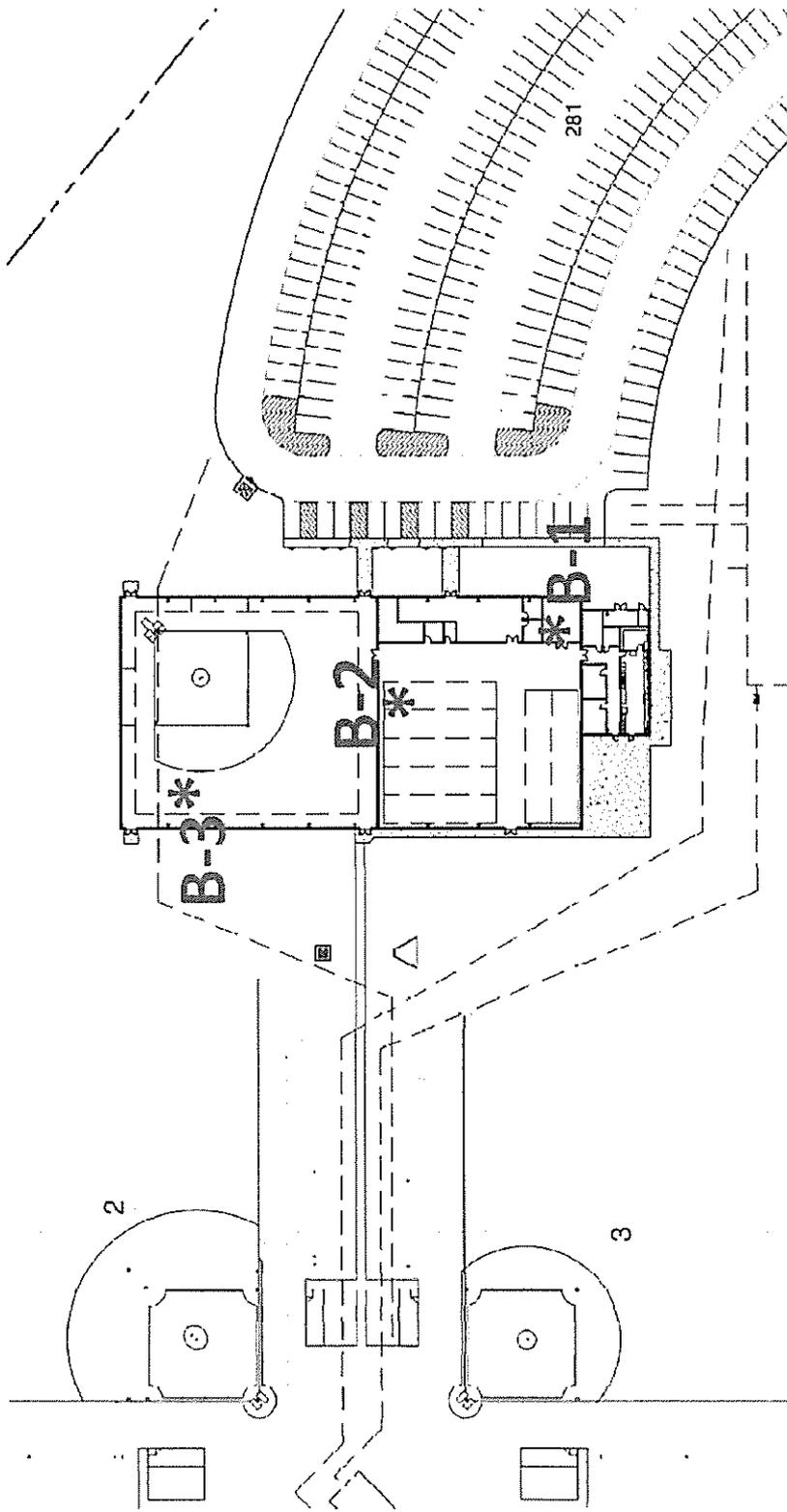
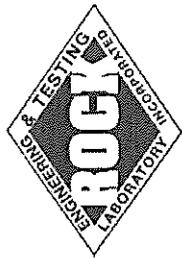
GENERAL COMMENTS

If significant changes are made in the character or location of the proposed project, a consultation should be arranged to review any changes with respect to the prevailing subsurface conditions. At that time, it may be necessary to submit supplementary recommendations.

It is recommended that the services of RETL be engaged to test and evaluate the soil materials in the foundation excavations areas prior to concreting in order to verify that the bearing materials are consistent with those encountered in the borings. RETL cannot accept any responsibility for any conditions that deviate from those described in this report, nor for the performance of the foundation if not engaged to also provide construction observation and testing for this project. If it is required for RETL to accept any liability, then RETL must agree with the plans and perform such observation during construction as we recommend.

All sheeting, shoring and bracing of trenches, pits and excavations should be made the responsibility of the contractor and should comply with all current and applicable local, state and federal safety codes, regulations and practices, including the Occupational Safety and Health Administration.

APPENDIX



BORING LOCATION PLAN

NO SCALE

May 18, 2016

Peter W. Lewis Architect + Associates, PLLC
RETL Project No.: G216136

PROPOSED FIELDHOUSE
City of Kerrville Athletic Complex
Kerrville, Texas

ROCK ENGINEERING AND TESTING LABORATORY, INC.
10856 VANDALE STREET
SAN ANTONIO, TX 78216

LOG OF BORING 01



Rock Engineering & Testing Laboratory, Inc.
 10856 Vandale Street
 San Antonio, Texas 78216
 Telephone: 210-495-8000
 Fax: 210-495-8015

CLIENT: Peter W. Lewis Architect + Associates, PLLC
 PROJECT: Kerrville Sports Complex Fieldhouse
 LOCATION: Kerrville, Texas
 NUMBER: G216136

DATE(S) DRILLED: 04/14/2016

FIELD DATA		LABORATORY DATA								DRILLING METHOD(S): Solid Stem Auger		
SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ.FT T: TONS/SQ.FT PERCENT RECOVERY/ ROCK QUALITY DESIGNATION	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION: Groundwater was not encountered during drilling, nor measured upon the completion of the drilling.
						LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI				
DESCRIPTION OF STRATUM												
[Hatched Pattern]	5	SPT S-1	N= 9	23	48	15	33			87	<u>LEAN CLAY</u> , dark brown, moist, stiff.	
[Hatched Pattern]		SPT S-2	N= 21	19	40	14	26			91	Same as above, brown, very stiff. (CL)	
[Hatched Pattern]		SPT S-3	N= 13	18							Same as above, with sand, stiff.	
[Hatched Pattern]		SPT S-4	N= 29	20	49	15	34			78	<u>LEAN CLAY</u> , with sand, brown, moist, very stiff. (CL)	
[Dotted Pattern]	10	SPT S-5	N= 31	8							<u>SILTY CLAYEY SAND</u> , with gravel, light brown, dry, hard.	
[Dotted Pattern]	15	SPT S-6	N= 59	5	NP	NP	NP			12	<u>SILTY GRAVEL</u> , light brown, dry, very dense. (GM)	
[Dotted Pattern]	20	SPT S-7	N= 14	28							<u>SILTY CLAYEY SAND</u> , tan, moist, very stiff.	
											Boring terminated at a depth of 20-feet.	

LOG_OF_BORING G216136 LOGS.GPJ ROCK_ETL.GDT 5/18/16

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - POCKET TORVANE SHEAR STRENGTH

REMARKS:
 Boring location determined by RETL. Drilling operations performed by RETL.
 GPS Coordinates: N 30° 04.454', W 99° 08.600'

LOG OF BORING 02



Rock Engineering & Testing Laboratory, Inc.
 10856 Vandale Street
 San Antonio, Texas 78216
 Telephone: 210-495-8000
 Fax: 210-495-8015

CLIENT: Peter W. Lewis Architect + Associates, PLLC
 PROJECT: Kerrville Sports Complex Fieldhouse
 LOCATION: Kerrville, Texas
 NUMBER: G216136
 DATE(S) DRILLED: 04/14/2016

FIELD DATA		LABORATORY DATA								DRILLING METHOD(S): Solid Stem Auger		
SOIL SYMBOL	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ.FT T: TONS/SQ.FT PERCENT RECOVERY/ ROCK QUALITY DESIGNATION	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION: Groundwater was not encountered during drilling, nor measured upon the completion of the drilling.
						LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI				SURFACE ELEVATION: N/A
DESCRIPTION OF STRATUM												
SPT S-1	5	N= 14	19	46	15	31			84	<u>LEAN CLAY</u> , with sand, dark brown, moist, stiff. (CL)		
SPT S-2		N= 26	16							Same as above, brown, very stiff.		
SH S-3		P= 4.5	20	36	15	21			75	Same as above. (CL)		
SH S-4		P= 4.5	15							<u>LEAN CLAY</u> , with sand, brown, moist, very stiff.		
SPT S-5	10	N= 11	14	19	14	5			40	<u>SILTY CLAYEY SAND</u> , light brown, moist, stiff. (SC-SM)		
SPT S-6	15	N= 26	10							Same as above, with gravel, slightly moist, very stiff.		
SPT S-7	20	N= 39	6							Same as above, dry, hard.		
											Boring terminated at a depth of 20-feet.	

LOG_OF_BORING G216136 LOGS.GPJ ROCK_ETL.GDT 5/18/16

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - POCKET TORVANE SHEAR STRENGTH

REMARKS:
 Boring location determined by RETL. Drilling operations performed by RETL.
 GPS Coordinates: N 30° 04.457', W 99° 08.584'

LOG OF BORING 03



Rock Engineering & Testing Laboratory, Inc.
 10856 Vandale Street
 San Antonio, Texas 78216
 Telephone: 210-495-8000
 Fax: 210-495-8015

CLIENT: Peter W. Lewis Architect + Associates, PLLC
 PROJECT: Kerrville Sports Complex Fieldhouse
 LOCATION: Kerrville, Texas
 NUMBER: G216136

DATE(S) DRILLED: 04/14/2016

DRILLING METHOD(S):
 Solid Stem Auger

GROUNDWATER INFORMATION:
 Groundwater was not encountered during drilling, nor measured upon the completion of the drilling.

SURFACE ELEVATION: N/A

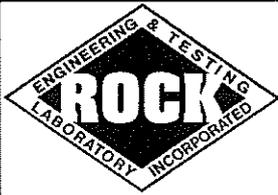
DESCRIPTION OF STRATUM

SOIL SYMBOL	FIELD DATA				LABORATORY DATA							MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
	DEPTH (FT)	SAMPLE NUMBER	SAMPLES	N: BLOWS/FT P: TONS/SQ.FT T: TONS/SQ.FT PERCENT RECOVERY/ ROCK QUALITY DESIGNATION	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)			
						LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI					
SPT S-1			N= 16	19									LEAN CLAY , with sand, dark brown, moist, very stiff.
SPT S-2			N= 21	18	44	14	30				84	Same as above, brown. (CL)	
SH S-3	5		P= 3.5	24	55	15	40				85	FAT CLAY , brown, moist, very stiff. (CH)	
SH S-4			P= 4.5	20	42	15	27				68	SANDY LEAN CLAY , brown, moist, very stiff. (CL)	
SPT S-5	10		N= 14	19									SILTY CLAYEY SAND , light brown, moist, stiff.
SPT S-6	15		N= 13	13									Same as above, with gravel.
SPT S-7	20		N= 28	12									Same as above, very stiff.
													Boring terminated at a depth of 20-feet.

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - POCKET TORVANE SHEAR STRENGTH

REMARKS:

Boring location determined by RETL. Drilling operations performed by RETL.
 GPS Coordinates: N 30° 04.459', W 99° 08.569'



Engineering & Testing
Laboratory, Inc.

Rock Engineering & Testing Laboratory
10856 Vandale
San Antonio, TX 78216
Telephone: 210-495-8000
Fax: 210-495-8015

KEY TO SOIL CLASSIFICATION AND SYMBOLS

UNIFIED SOIL CLASSIFICATION SYSTEM			TERMS CHARACTERIZING SOIL STRUCTURE	
MAJOR DIVISIONS	SYMBOL	NAME		
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW	Well Graded Gravels or Gravel-Sand mixtures, little or no fines	SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical LAMINATED (VARVED) - composed of thin layers of varying color and texture, usually grading from sand or silt at the bottom to clay at the top
		GP	Poorly Graded Gravels or Gravel-Sand mixtures, little or no fines	
		GM	Silty Gravels, Gravel-Sand-Silt mixtures	
		GC	Clayey Gravels, Gravel-Sand-Clay Mixtures	
	SAND AND SANDY SOILS	SW	Well Graded Sands or Gravelly Sands, little or no fines	CRUMBLY - cohesive soils which break into small blocks or crumbs on drying CALCAREOUS - containing appreciable quantities of calcium carbonate, generally nodular WELL GRADED - having wide range in grain sizes and substantial amounts of all intermediate particle sizes POORLY GRADED - predominantly of one grain size uniformly graded) or having a range of sizes with some intermediate size missing (gap or skip graded)
		SP	Poorly Graded Sands or Gravelly Sands, little or no fines	
		SM	Silty Sands, Sand-Silt Mixtures	
		SC	Clayey Sands, Sand-Clay mixtures	
FINE GRAINED SOILS	SILTS AND CLAYS LL < 50	ML	Inorganic Silts and very fine Sands, Rock Flour, Silty or Clayey fine Sands or Clayey Silts	<p>SYMBOLS FOR TEST DATA</p> <p> — Groundwater Level (Initial Reading)</p> <p> — Groundwater Level (Final Reading)</p> <p> — Shelby Tube Sample</p> <p> — SPT Samples</p> <p> — Auger Sample</p> <p> — Rock Core</p>
		CL	Inorganic Clays of low to medium plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays	
		OL	Organic Silts and Organic Silt-Clays of low plasticity	
	SILTS AND CLAYS LL > 50	MH	Inorganic Silts, Micaceous or Diatomaceous fine Sandy or Silty soils, Elastic Silts	
		CH	Inorganic Clays of high plasticity, Fat Clays	
		OH	Organic Clays of medium to high plasticity, Organic Silts	
HIGHLY ORGANIC SOILS	PT	Peat and other Highly Organic soils		

TERMS DESCRIBING CONSISTENCY OF SOIL

COARSE GRAINED SOILS		FINE GRAINED SOILS		
DESCRIPTIVE TERM	NO. BLOWS/FT. STANDARD PEN. TEST	DESCRIPTIVE TERM	NO. BLOWS/FT. STANDARD PEN. TEST	UNCONFINED COMPRESSION TONS PER SQ. FT.
Very Loose	0 - 4	Very Soft	< 2	< 0.25
Loose	4 - 10	Soft	2 - 4	0.25 - 0.50
Medium	10 - 30	Firm	4 - 8	0.50 - 1.00
Dense	30 - 50	Stiff	8 - 15	1.00 - 2.00
Very Dense	over 50	Very Stiff	15 - 30	2.00 - 4.00
		Hard	over 30	over 4.00

Field Classification for "Consistency" is determined with a 0.25" diameter penetrometer



Envelope Compliance Certificate

Section 1: Project Information

Energy Code: **2009 IECC**

Project Title: City of Kerrville Athletic Complex Field House

Project Type: New Construction

Construction Site:
Kerrville, TX 78028

Owner/Agent:
Malcolm Matthews
City of Kerrville
Kerrville, TX 78028
Malcolm.Matthews@kerrvilletx.gov

Designer/Contractor:
Peter Lewis
Peter Lewis Architect + Associates
334 West Water Street
Kerrville, TX 78028
8308964220
peter@pwlarchitect.com

Building Location (for weather data): Kerrville, Texas
Climate Zone: 3b
Vertical Glazing / Wall Area Pct.: 7%

<u>Building Use: Activity Type(s)</u>	<u>Floor Area</u>
1-Gymnasium : Nonresidential	17714

Section 2: Envelope Assemblies and Requirements Checklist

Envelope PASSES: Design 3% better than code.

Envelope Assemblies:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor ^(a)
Orientation: NORTH					
Exterior Wall 4: Metal Building Wall, Single Layer Mineral Fiber, [Bldg. Use 1 - Gymnasium]	2082	19.0	0.0	0.113	0.084
Door 2: Insulated Metal, Swinging, [Bldg. Use 1 - Gymnasium]	42	---	---	0.210	0.700
Exterior Wall 5: Metal Building Wall, Single Layer Mineral Fiber, [Bldg. Use 1 - Gymnasium]	363	19.0	0.0	0.113	0.084
Door 3: Insulated Metal, Swinging, [Bldg. Use 1 - Gymnasium]	21	---	---	0.210	0.700
Door 3 copy 1: Insulated Metal, Swinging, [Bldg. Use 1 - Gymnasium]	42	---	---	0.210	0.700
Orientation: EAST					
Exterior Wall 3: Metal Building Wall, Single Layer Mineral Fiber, [Bldg. Use 1 - Gymnasium]	2260	19.0	0.0	0.113	0.084
Window 10: Metal Frame with Thermal Break, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, [Bldg. Use 1 - Gymnasium]	90	---	---	0.650	0.650
Door 1: Insulated Metal, Swinging, [Bldg. Use 1 - Gymnasium]	42	---	---	0.210	0.700
Exterior Wall 6: Metal Building Wall, Single Layer Mineral Fiber, [Bldg. Use 1 - Gymnasium]	2349	19.0	0.0	0.113	0.084
Door 5: Insulated Metal, Swinging, [Bldg. Use 1 - Gymnasium]	42	---	---	0.210	0.700
Door 6: Uninsulated Single-Layer Metal, Non-Swinging, [Bldg. Use 1 - Gymnasium]	23	---	---	0.990	1.450
Door 7: Uninsulated Single-Layer Metal, Non-Swinging, [Bldg. Use 1 - Gymnasium]	23	---	---	0.990	1.450
Orientation: SOUTH					
Exterior Wall 1: Metal Building Wall, Single Layer Mineral Fiber, [Bldg. Use 1 - Gymnasium]	1571	19.0	0.0	0.113	0.084
Window 1: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650

Window 1 copy 1: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650
Window 1 copy 2: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650
Window 1 copy 3: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650
Window 1 copy 4: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650
Window 1 copy 5: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650
Window 1 copy 6: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650
Window 1 copy 7: Metal Frame with Thermal Break:Fixed, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 0.54, [Bldg. Use 1 - Gymnasium]	46	---	---	0.650	0.650
Window 9: Metal Frame with Thermal Break, Perf. Type: Energy code default, Double Pane with Low-E, Tinted , SHGC 0.60, PF 1.00, [Bldg. Use 1 - Gymnasium]	190	---	---	0.650	0.650
Exterior Wall 2: Metal Building Wall, Single Layer Mineral Fiber, [Bldg. Use 1 - Gymnasium]	431	19.0	0.0	0.113	0.084
Orientation: UNSPECIFIED ORIENTATION					
Roof 1: Metal Building, Screw Down, [Bldg. Use 1 - Gymnasium]	17714	19.0	11.0	0.047	0.055
Floor 1: Slab-On-Grade:Unheated, [Bldg. Use 1 - Gymnasium]	571	---	---	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Air Leakage, Component Certification, and Vapor Retarder Requirements:

- 1. All joints and penetrations are caulked, gasketed or covered with a moisture vapor-permeable wrapping material installed in accordance with the manufacturer's installation instructions.
- 2. Windows, doors, and skylights certified as meeting leakage requirements.
- 3. Component R-values & U-factors labeled as certified.
- 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.
- 5. 'Other' components have supporting documentation for proposed U-Factors.
- 6. Insulation installed according to manufacturer's instructions, in substantial contact with the surface being insulated, and in a manner that achieves the rated R-value without compressing the insulation.
- 7. Stair, elevator shaft vents, and other outdoor air intake and exhaust openings in the building envelope are equipped with motorized dampers.
- 8. Cargo doors and loading dock doors are weather sealed.
- 9. Recessed lighting fixtures installed in the building envelope are Type IC rated as meeting ASTM E283, are sealed with gasket or caulk.
- 10. Building entrance doors have a vestibule equipped with self-closing devices.

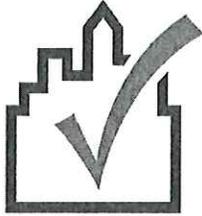
Exceptions:

- Building entrances with revolving doors.
- Doors not intended to be used as a building entrance.
- Doors that open directly from a space less than 3000 sq. ft. in area.
- Doors used primarily to facilitate vehicular movement or materials handling and adjacent personnel doors.
- Doors opening directly from a sleeping/dwelling unit.

Section 3: Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the 2009 IECC requirements in COMcheck Version 4.0.4.1 and to comply with the mandatory requirements in the Requirements Checklist.

Keith Watson - Project Manager		10/21/16
Name - Title	Signature	Date



COMcheck Software Version 3.9.3

Mechanical Compliance Certificate

2006 IECC

Section 1: Project Information

Project Type: **New Construction**

Project Title : City of Kerrville Athletic Complex Field House

Construction Site:
Kerrville, TX

Owner/Agent:

Designer/Contractor:

Bruce Smith, P.E.
ESA Mechanical & Electrical
Engineering, Inc.
1100 NW Loop 410, Ste. 810
San Antonio, TX 78213
210-342-3483

Section 2: General Information

Building Location (for weather data): **Kerrville, Texas**
Climate Zone: **3b**

Section 3: Mechanical Systems List

Quantity System Type & Description

- 2 Cu/AHU-6 & 7 (Single Zone) : Split System Heat Pump
Heating Mode: Capacity = 68 kBtu/h,
Proposed Efficiency = 3.10 COP, Required Efficiency = 3.10 COP
Cooling Mode: Capacity = 150 kBtu/h, , No Economizer , Economizer exception: High Efficiency Equipment
Proposed Efficiency = 12.00 EER, Required Efficiency = 10.70 EER
- 2 CU/AHU-3 & 4 (Single Zone) : Split System Heat Pump
Heating Mode: Capacity = 25 kBtu/h,
Proposed Efficiency = 9.00 HSPF, Required Efficiency = 6.80 HSPF
Cooling Mode: Capacity = 44 kBtu/h,
Proposed Efficiency = 17.00 SEER, Required Efficiency = 10.00 SEER
- 1 CU/AHU-5 (Single Zone) : Split System Heat Pump
Heating Mode: Capacity = 37 kBtu/h,
Proposed Efficiency = 9.00 HSPF, Required Efficiency = 6.80 HSPF
Cooling Mode: Capacity = 60 kBtu/h, , No Economizer , Economizer exception: High Efficiency Equipment
Proposed Efficiency = 16.00 SEER, Required Efficiency = 11.50 SEER
- 1 CU/AHU-1 (Single Zone) : Split System Heat Pump
Heating Mode: Capacity = 20 kBtu/h,
Proposed Efficiency = 9.00 HSPF, Required Efficiency = 6.80 HSPF
Cooling Mode: Capacity = 35 kBtu/h,
Proposed Efficiency = 17.00 SEER, Required Efficiency = 10.00 SEER
- 1 CU/AHU-2 (Single Zone) : Split System Heat Pump
Heating Mode: Capacity = 20 kBtu/h,
Proposed Efficiency = 9.00 HSPF, Required Efficiency = 6.80 HSPF
Cooling Mode: Capacity = 35 kBtu/h,
Proposed Efficiency = 17.00 SEER, Required Efficiency = 10.00 SEER
- 1 Water Heater: WH-1:
Electric Storage Water Heater, Capacity: 120 gallons w/ Circulation Pump
Proposed Efficiency: 0.77 EF, Required Efficiency: 0.77 EF

Section 4: Requirements Checklist

Requirements Specific To: Cu/AHU-6 & 7 :

- 1. Equipment minimum efficiency: Heat Pump: 3.10 COP 10.70 EER
- 2. Integrated air economizer required

Requirements Specific To: CU/AHU-3 & 4 :

- 1. Equipment minimum efficiency: Heat Pump: 6.80 HSPF 10.00 SEER

Requirements Specific To: CU/AHU-5 :

- 1. Equipment minimum efficiency: Heat Pump: 6.80 HSPF 11.50 SEER
- 2. Integrated air economizer required

Requirements Specific To: CU/AHU-1 :

- 1. Equipment minimum efficiency: Heat Pump: 6.80 HSPF 10.00 SEER

Requirements Specific To: CU/AHU-2 :

- 1. Equipment minimum efficiency: Heat Pump: 6.80 HSPF 10.00 SEER

Requirements Specific To: Water Heater: WH-1 :

- 1. Water heating equipment meets minimum efficiency requirements: Electric Water Heater efficiency: 0.77 EF (403 SL, Btu/h (if > 12 kW))
- 2. Hot water system sized per manufacturer's sizing guide
- 3. All piping in circulating system insulated
- 4. Hot water storage temperature adjustable down to 120°F or lower
- 5. Automatic time control of heat tapes and recirculating systems present
- 6. Controls will shut off operation of circulating pump between water heater/boiler and storage tanks within 5 minutes after end of heating cycle

Generic Requirements: Must be met by all systems to which the requirement is applicable:

- 1. Plant equipment and system capacity no greater than needed to meet loads
Exception(s):
 - Standby equipment automatically off when primary system is operating
 - Multiple units controlled to sequence operation as a function of load
- 2. Minimum one temperature control device per system
- 3. Minimum one humidity control device per installed humidification/dehumidification system
- 4. Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock, 2-hour occupant override, 10-hour backup
Exception(s):
 - Continuously operating zones
- 5. Outside-air source for ventilation; system capable of reducing OSA to required minimum
- 6. R-5 supply and return air duct insulation in unconditioned spaces
R-8 supply and return air duct insulation outside the building
R-8 insulation between ducts and the building exterior when ducts are part of a building assembly
Exception(s):
 - Ducts located within equipment
 - Ducts with interior and exterior temperature difference not exceeding 15°F.
- 7. Mechanical fasteners and sealants used to connect ducts and air distribution equipment
- 8. Ducts sealed - longitudinal seams on rigid ducts; transverse seams on all ducts; UL 181A or 181B tapes and mastics
- 9. Hot water pipe insulation: 1 in. for pipes <=1.5 in. and 2 in. for pipes >1.5 in.
Chilled water/refrigerant/brine pipe insulation: 1 in. for pipes <=1.5 in. and 1.5 in. for pipes >1.5 in.
Steam pipe insulation: 1.5 in. for pipes <=1.5 in. and 3 in. for pipes >1.5 in.
Exception(s):
 - Piping within HVAC equipment.
 - Fluid temperatures between 55 and 105°F.
 - Fluid not heated or cooled with renewable energy.
 - Runouts <4 ft in length.
- 10. Operation and maintenance manual provided to building owner
- 11. Piping, insulated to 1/2 in. if nominal diameter of pipe is <1.5 in.;
Larger pipe insulated to 1 in. thickness
- 12. Lavatory faucet outlet temperatures in public restrooms limited to 110°F (43°C)
- 13. Load calculations per acceptable engineering standards and handbooks
- 14. Balancing devices provided in accordance with IMC 603.17

- 15. Motorized, automatic shutoff dampers required on exhaust and outdoor air supply openings
Exception(s):
 - Gravity dampers acceptable in buildings <3 stories
- 16. Exhaust air heat recovery included for systems 5,000 cfm or greater with more than 70% outside air fraction or specifically exempted
Exception(s):
 - Systems serving spaces that are not cooled and heated to <60°F.
 - Commercial kitchen hoods (grease) classified as Type 1 by NFPA 96.
 - Systems exhausting toxic, flammable, paint, or corrosive fumes or dust.
 - Where the largest exhaust source is less than 75% of the design outdoor airflow.
 - Systems requiring dehumidification that employ energy recovery in series with the cooling coil.

Section 5: Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2006 IECC requirements in COMcheck Version 3.9.3 and to comply with the mandatory requirements in the Requirements Checklist.

Bruce C. Smith, P.E.

Name - Title

Bruce Smith

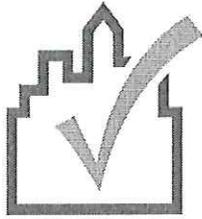
Signature

10/21/16

Date

Project Notes:

TBPE Firm Registration No. F-4137



COMcheck Software Version 3.9.3 Interior Lighting Compliance Certificate

2006 IECC

Section 1: Project Information

Project Type: **New Construction**

Project Title : City of Kerrville Athletic Complex Field House

Construction Site:
Kerrville, TX

Owner/Agent:

Designer/Contractor:

Stephen Mitchell, P.E. LEED AP BD+C
ESA Mechanical & Electrical
Engineering, Inc.
1100 NW Loop 410
Suite 810
San Antonio, TX 78213
210-342-3483

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft ²)	C Allowed Watts / ft ²	D Allowed Watts (B x C)
Sports Arena	17714	1.1	19485
Total Allowed Watts =			19485

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Sports Arena (17714 sq.ft.)				
LED 1: A, AE: Suspended Linear Strip: Other:	1	21	66.6	1398.6
LED 2: B, BE: 2'x4' LED Troffer: Other:	1	54	45	2430
LED 3: C: 2'x4' LED Troffer: Other:	1	8	71	568
LED 4: D: LED High Bay: Other:	1	50	150	7500
Total Proposed Watts =				11897

Section 4: Requirements Checklist

Interior Lighting PASSES: Design 39% better than code.

Lighting Wattage:

1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
19485	11897	YES

Controls, Switching, and Wiring:

2. Independent controls for each space (switch/occupancy sensor).

Exceptions:

- Areas designated as security or emergency areas that must be continuously illuminated.
- Lighting in stairways or corridors that are elements of the means of egress.
3. Master switch at entry to hotel/motel guest room.

- 4. Individual dwelling units separately metered.
- 5. Each space required to have a manual control also allows for reducing the connected lighting load by at least 50 percent by either controlling all luminaires, dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps, switching the middle lamp luminaires independently of other lamps, or switching each luminaire or each lamp.

Exceptions:

- Only one luminaire in space.
- An occupant-sensing device controls the area.
- The area is a corridor, storeroom, restroom, public lobby or sleeping unit.
- Areas that use less than 0.6 Watts/sq.ft.
- 6. Automatic lighting shutoff control in buildings larger than 5,000 sq.ft.

Exceptions:

- Sleeping units, patient care areas; and spaces where automatic shutoff would endanger safety or security.
- 7. Photocell/astronomical time switch on exterior lights.

Exceptions:

- Lighting intended for 24 hour use.
- 8. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

Exceptions:

- Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.

Section 5: Compliance Statement

Compliance Statement: The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2006 IECC requirements in COMcheck Version 3.9.3 and to comply with the mandatory requirements in the Requirements Checklist.

<u>STEPHEN MITCHELL, P.E.</u>	<u>Stephen Mitchell</u>	<u>10-21-16</u>
Name - Title	Signature	Date

Project Notes:

TBPE Firm Registration No. F-4137



COMcheck Software Version 3.9.3 Exterior Lighting Compliance Certificate

2006 IECC

Section 1: Project Information

Project Type: **New Construction**

Project Title : City of Kerrville Athletic Complex Field House

Construction Site:
Kerrville, TX

Owner/Agent:

Designer/Contractor:

Stephen Mitchell, P.E. LEED AP BD+C
ESA Mechanical & Electrical
Engineering, Inc.
1100 NW Loop 410
Suite 810
San Antonio, TX 78213
210-342-3483

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B x C)	F Proposed Watts
Walkway < 10 feet wide	160 ft of walkway length	1	Yes	160	141
Walkway >= 10 feet wide	3642 ft2	0.2	Yes	728	376
Illuminated length of wall or surface	56 ft	5	No	280	329
Baseball Field (Special feature area)	1000 ft2	0.2	Yes	200	0
Total Tradable Watts* =				1088	517
Total Allowed Watts =				1368	
Total Allowed Supplemental Watts** =				68	

* Wattage tradeoffs are only allowed between tradable areas/surfaces.

** A supplemental allowance equal to 5% of total allowed wattage may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Walkway < 10 feet wide (160 ft of walkway length): Tradable Wattage				
LED 1: W1, W1E: LED Wall Pack: Other:	1	3	47	141
Walkway >= 10 feet wide (3642 ft2): Tradable Wattage				
LED 2: W1, W1E: LED Wall Pack: Other:	1	8	47	376
Illuminated length of wall or surface (56 ft): Non-tradable Wattage				
LED 3: W1, W1E: LED Wall Pack: Other:	1	7	47	329
Baseball Field (Special feature area 1000 ft2): Tradable Wattage				
HID 1-Relocated Ball Field Light: Relocated Ball Field Lights: Baseball Field Light Pole: Metal Halide: Standard: Exemption: Athletic playing areas	4	4	1625	Exempt
Total Tradable Proposed Watts =				517

Section 4: Requirements Checklist

Lighting Wattage:

- 1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Compliance: Passes using supplemental allowance watts.

Controls, Switching, and Wiring:

- 2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.
- 3. All lighting fixtures are controlled by a photosensor or astronomical time switch that is capable of automatically turning off the fixture when sufficient daylight is available or the lighting is not required.

Exceptions:

- Covered vehicle entrance/exit areas requiring lighting for safety, security and eye adaptation.

Exterior Lighting Efficacy:

- 4. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumen/watt.

Exceptions:

- Controlled by motion sensor or exempt from consideration under the provisions of Section 505.6.2.

Section 5: Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2006 IECC requirements in COMcheck Version 3.9.3 and to comply with the mandatory requirements in the Requirements Checklist.

STEPHEN MITCHELL, P.E.
Name - Title

Stephen Mitchell
Signature

10-21-16
Date

***City Of Kerrville-Athletic Complex Field
HVAC Load Analysis***

for

Peter Lewis Architect + Associates



CHVAC COMMERCIAL
HVAC LOADS

Prepared By:
Rezaur Rahman, P.E. LEED AP+C
ESA Mechanical & Electrical Engineering
1100 NW Loop 410, Ste. 810
San Antonio
210-342-3483
Thursday, October 20, 2016



General Project Data Input

General Project Information

Project file name: R:\ESA-JOBS\16022-City of Kerrville Athletic Complex Field House\HVAC\COK-Athletic Complex Field house.CHV
 Project title: City Of Kerrville-Athletic Complex Field
 Designed by: ESA Engineering
 Project date: June 2016
 Project location: Kerrville, TEXAS, USA
 Client name: Peter Lewis Architect + Associates
 Company name: ESA Mechanical & Electrical Engineering
 Company representative: Rezaur Rahman, P.E. LEED AP+
 Company address: 1100 NW Loop 410, Ste. 810
 Company city: San Antonio
 Company phone: 210-342-3483

Barometric pressure: 29.079 in.Hg.
 Altitude: 788 feet
 Latitude: 30 Degrees
 Mean daily temperature range: 22 Degrees
 Starting and ending time for HVAC load calculations: 1am - 12am
 Floor heat loss coefficient: 0 Btuh per foot of slab
 Number of unique zones in this project: 13

Building Default Values

Calculations performed: Both heating and cooling loads
 Lighting requirements: 1.20 Watts per square foot
 Equipment requirements: 0.00 Watts per square foot
 People sensible load multiplier: 275 Btuh per person
 People latent load multiplier: 475 Btuh per person
 Zone sensible safety factor: 5 %
 Zone latent safety factor: 5 %
 Zone heating safety factor: 25 %
 People diversity factor: 100 %
 Lighting profile number: 0
 Equipment profile number: 0
 People profile number: 0
 Building default ceiling height: 10.0 feet
 Building default wall height: 16.0 feet

Internal Operating Load Profiles (C = 100)

	hr																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
2	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
3	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
4	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
5	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
6	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
7	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
8	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
9	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
10	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C



General Project Data Input (cont'd)

Building-Level Design Conditions

Design Month	Outdoor Dry Bulb	Outdoor Wet Bulb	Indoor Rel.Hum	Indoor Dry Bulb	Grains Diff	In/Outdoor Correction
August	101	74	50%	75	20.01	8
June	99	75	50%	75	29.38	6
July	99	74	50%	75	23.24	6
September	97	74	50%	75	26.48	4
January	76	62	50%	75	-3.58	-17
December	77	64	50%	75	4.34	-16
Winter	25			75		

Master Roofs

Roof No.	ASHRAE Roof#	Roof U-Fac	Dark Color	Susp. Ceil
1	1	0.033	No	Yes

Master Walls

Wall No.	ASHRAE Group	Wall U-Fac	Wall Color
1	B	0.052	L

Master Glass

Glass No.	Summer U-Factor	Winter U-Factor	Glass Shd.Coef.	Interior Shading	Interior Shd.Coef	Room Const	Glass Width	Glass Height
1	0.290	0.290	0.460	3	0.000	M	6.500	7.000
2	0.290	0.290	0.460	3	0.000	M	19.000	10.000
3	0.290	0.290	0.460	3	0.000	M	3.000	7.000



Building Summary Loads

Building peaks in September at 1pm.

Bldg Load Descriptions	Area Quan	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Roof	16,634	34,308	14.88	0	21,470	21,470	5.04
Wall	7,012	22,789	9.88	0	4,433	4,433	1.04
Glass	708	12,833	5.57	0	38,888	38,888	9.13
Floor Slab	0	0	0.00	0	0	0	0.00
Skin Loads		69,929	30.33	0	64,790	64,790	15.22
Lighting	19,961	0	0.00	0	71,515	71,515	16.80
Equipment	7,112	0	0.00	0	25,481	25,481	5.98
People	163	0	0.00	81,296	47,066	128,363	30.15
Partition	0	0	0.00	0	0	0	0.00
Cool. Pret.	0	0	0.00	0	0	0	0.00
Heat. Pret.	0	0	0.00	0	0	0	0.00
Cool. Vent.	3,061	0	0.00	60,138	65,447	125,585	29.50
Heat. Vent.	3,061	160,642	69.67	0	0	0	0.00
Cool. Infil.	0	0	0.00	0	0	0	0.00
Heat. Infil.	0	0	0.00	0	0	0	0.00
Draw-Thru Fan	0	0	0.00	0	10,026	10,026	2.35
Blow-Thru Fan	0	0	0.00	0	0	0	0.00
Reserve Cap.	0	0	0.00	0	0	0	0.00
Reheat Cap.	0	0	0.00	0	0	0	0.00
Supply Duct	0	0	0.00	0	0	0	0.00
Return Duct	0	0	0.00	0	0	0	0.00
Misc. Supply	0	0	0.00	0	0	0	0.00
Misc. Return	0	0	0.00	0	0	0	0.00
Building Totals		230,571	100.00	141,435	284,324	425,759	100.00

Building Summary	Sen Loss	%Tot Loss	Lat Gain	Sen Gain	Net Gain	%Net Gain
Ventilation	160,642	69.67	60,138	65,447	125,585	29.50
Infiltration	0	0.00	0	0	0	0.00
Pretreated Air	0	0.00	0	0	0	0.00
Zone Loads	69,929	30.33	81,296	208,852	290,148	68.15
Plenum Loads	0	0.00	0	0	0	0.00
Fan & Duct Loads	0	0.00	0	10,026	10,026	2.35
Building Totals	230,571	100.00	141,435	284,324	425,759	100.00

Check Figures

Total Building Supply Air (based on a 20° TD):	11,196	CFM
Total Building Vent. Air (27.34% of Supply):	3,061	CFM
Total Conditioned Air Space:	16,634	Sq.ft
Supply Air Per Unit Area:	0.6731	CFM/Sq.ft
Area Per Cooling Capacity:	468.8287	Sq.ft/Ton
Cooling Capacity Per Area:	0.0021	Tons/Sq.ft
Total Heating Required With Outside Air:	230,571	Btuh
Total Cooling Required With Outside Air:	35.48	Tons



Air Handler #1 Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
1	Concession 113 2pm June	536	4,746	18,038	2,993	Direct	Direct
		6	226	880	0	126	126
		5,360	0.42	1.64	0	132	141
2	Pantry 114 3pm August	104	631	1,092	0	Direct	Direct
		0	30	53	0	24	24
		1,040	0.29	0.51	0	18	9
Zone Peak Totals:		640	5,376	19,130	2,993		
Total Zones: 2		6	256	933	0	150	150
Unique Zones: 2		6,400	0.40	1.46	0	150	150



Air Handler #1 Total Load Summary

Air Handler Description: **AHU-1 Constant Volume - Proportion**
 Supply Air Fan: Draw-Thru with program estimated horsepower of 0.34 HP
 Fan Input: 65% motor and fan efficiency with 1.5 in. water across the fan
 Sensible Heat Ratio: 0.87 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 2pm in June.
 Outdoor Conditions: 98° DB, 75° WB, 97.00 grains

Summer: Ventilation controls outside air, ---- Winter: Ventilation controls outside air.

Zone Space sensible loss:	5,376 Btuh		
Infiltration sensible loss:	0 Btuh	0 CFM	
Outside Air sensible loss:	7,872 Btuh	150 CFM	
Supply Duct sensible loss:	0 Btuh		
Return Duct sensible loss:	0 Btuh		
Return Plenum sensible loss:	0 Btuh		
Total System sensible loss:			13,248 Btuh

Heating Supply Air: $5,376 / (.972 \times 1.08 \times 20) =$	256 CFM
Winter Vent Outside Air (58.6% of supply) =	150 CFM

Zone space sensible gain:	19,113 Btuh		
Infiltration sensible gain:	0 Btuh		
Draw-thru fan sensible gain:	835 Btuh		
Supply duct sensible gain:	0 Btuh		
Reserve sensible gain:	0 Btuh		
Total sensible gain on supply side of coil:			19,948 Btuh

Cooling Supply Air: $19,948 / (.972 \times 1.1 \times 20) =$	933 CFM
Summer Vent Outside Air (16.1% of supply) =	150 CFM

Return duct sensible gain:	0 Btuh		
Return plenum sensible gain:	0 Btuh		
Outside air sensible gain:	3,688 Btuh	150 CFM	
Blow-thru fan sensible gain:	0 Btuh		
Total sensible gain on return side of coil:			3,688 Btuh
Total sensible gain on air handling system:			23,636 Btuh

Zone space latent gain:	2,993 Btuh		
Infiltration latent gain:	0 Btuh		
Outside air latent gain:	3,074 Btuh		
Total latent gain on air handling system:			6,067 Btuh
Total system sensible and latent gain:			29,703 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):	933 CFM
Total Air Handler Vent. Air (16.08% of Supply):	150 CFM
Total Conditioned Air Space:	640 Sq.ft
Supply Air Per Unit Area:	1.4578 CFM/Sq.ft
Area Per Cooling Capacity:	258.5600 Sq.ft/Ton
Cooling Capacity Per Area:	0.0039 Tons/Sq.ft
Total Heating Required With Outside Air:	13,248 Btuh
Total Cooling Required With Outside Air:	2.48 Tons



Air Handler #2 Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
3	MEP 115 5pm August	198	1,994	2,535	0	Direct	Direct
		0	95	122	0	23	23
		1,980	0.48	0.62	0	44	26
4	Umpire Locker Room 109 3pm August	154	1,150	3,161	997	Direct	Direct
		2	55	152	0	18	18
		1,540	0.36	0.99	0	25	32
5	Corridor 108 2pm June	503	2,078	6,265	2,993	Direct	Direct
		6	99	301	0	58	58
		5,030	0.20	0.60	0	46	64
6	Womens 110 3pm August	224	462	1,325	0	Direct	Direct
		0	22	64	0	26	26
		2,240	0.10	0.28	0	10	13
7	Mens 112 3pm August	225	1,140	1,473	0	Direct	Direct
		0	54	71	0	26	26
		2,250	0.24	0.31	0	25	15
Zone Peak Totals:		1,304	6,824	14,759	3,990		
Total Zones: 5		8	325	710	0	150	150
Unique Zones: 5		13,040	0.25	0.54	0	150	150



Air Handler #2 Total Load Summary

Air Handler Description: **AHU-2** Constant Volume - Proportion
 Supply Air Fan: Draw-Thru with program estimated horsepower of 0.26 HP
 Fan Input: 65% motor and fan efficiency with 1.5 in. water across the fan
 Sensible Heat Ratio: 0.79 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 3pm in June.
 Outdoor Conditions: 99° DB, 75° WB, 95.93 grains

Summer: Ventilation controls outside air, ---- Winter: Ventilation controls outside air.

Zone Space sensible loss:	6,824 Btuh	
Infiltration sensible loss:	0 Btuh	0 CFM
Outside Air sensible loss:	7,872 Btuh	150 CFM
Supply Duct sensible loss:	0 Btuh	
Return Duct sensible loss:	0 Btuh	
Return Plenum sensible loss:	0 Btuh	
Total System sensible loss:		14,696 Btuh

Heating Supply Air: $6,824 / (.972 \times 1.08 \times 20) =$	325 CFM
Winter Vent Outside Air (46.1% of supply) =	150 CFM

Zone space sensible gain:	14,537 Btuh	
Infiltration sensible gain:	0 Btuh	
Draw-thru fan sensible gain:	635 Btuh	
Supply duct sensible gain:	0 Btuh	
Reserve sensible gain:	0 Btuh	
Total sensible gain on supply side of coil:		15,173 Btuh

Cooling Supply Air: $15,173 / (.972 \times 1.1 \times 20) =$	710 CFM
Summer Vent Outside Air (21.1% of supply) =	150 CFM

Return duct sensible gain:	0 Btuh	
Return plenum sensible gain:	0 Btuh	
Outside air sensible gain:	3,849 Btuh	150 CFM
Blow-thru fan sensible gain:	0 Btuh	
Total sensible gain on return side of coil:		3,849 Btuh
Total sensible gain on air handling system:		19,022 Btuh

Zone space latent gain:	3,990 Btuh	
Infiltration latent gain:	0 Btuh	
Outside air latent gain:	2,914 Btuh	
Total latent gain on air handling system:		6,904 Btuh
Total system sensible and latent gain:		25,925 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):	710 CFM
Total Air Handler Vent. Air (21.14% of Supply):	150 CFM
Total Conditioned Air Space:	1,304 Sq.ft
Supply Air Per Unit Area:	0.5442 CFM/Sq.ft
Area Per Cooling Capacity:	603.5867 Sq.ft/Ton
Cooling Capacity Per Area:	0.0017 Tons/Sq.ft
Total Heating Required With Outside Air:	14,696 Btuh
Total Cooling Required With Outside Air:	2.16 Tons



Air Handler #3 Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
8	Office 104 1pm December	151	2,184	6,034	499	Direct	Direct
		1	104	293	0	20	20
		1,510	0.69	1.94	0	39	28
9	Office 103 1pm December	119	1,494	6,009	499	Direct	Direct
		1	71	292	0	20	20
		1,190	0.60	2.46	0	27	28
10	Pro Shop 100 1pm December	1,412	12,762	51,814	5,985	Direct	Direct
		12	608	2,520	0	240	240
		14,120	0.43	1.78	0	228	240
11	Storege 101 3pm August	204	421	1,207	0	Direct	Direct
		0	20	59	0	21	21
		2,040	0.10	0.29	0	8	6
Zone Peak Totals:		1,886	16,861	65,063	6,983		
Total Zones: 4		14	803	3,164	0	301	301
Unique Zones: 4		18,860	0.43	1.68	0	301	301



Air Handler #3 Total Load Summary

Air Handler Description: **AHU-3 And AHU- 4** Constant Volume - Proportion
 Supply Air Fan: Draw-Thru with program estimated horsepower of 1.15 HP
 Fan Input: 65% motor and fan efficiency with 1.5 in. water across the fan
 Sensible Heat Ratio: 0.90 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 1pm in December.
 Outdoor Conditions: 75° DB, 64° WB, 74.78 grains

Summer: Ventilation controls outside air, ---- Winter: Ventilation controls outside air.

Zone Space sensible loss:	16,861 Btuh	
Infiltration sensible loss:	0 Btuh	0 CFM
Outside Air sensible loss:	15,797 Btuh	301 CFM
Supply Duct sensible loss:	0 Btuh	
Return Duct sensible loss:	0 Btuh	
Return Plenum sensible loss:	0 Btuh	
Total System sensible loss:		32,658 Btuh

Heating Supply Air: $16,861 / (.972 \times 1.08 \times 20) =$	803 CFM
Winter Vent Outside Air (37.5% of supply) =	301 CFM

Zone space sensible gain:	64,815 Btuh	
Infiltration sensible gain:	0 Btuh	
Draw-thru fan sensible gain:	2,833 Btuh	
Supply duct sensible gain:	0 Btuh	
Reserve sensible gain:	0 Btuh	
Total sensible gain on supply side of coil:		67,648 Btuh

Cooling Supply Air: $67,648 / (.972 \times 1.1 \times 20) =$	3,164 CFM
Summer Vent Outside Air (9.5% of supply) =	301 CFM

Return duct sensible gain:	0 Btuh	
Return plenum sensible gain:	0 Btuh	
Outside air sensible gain:	0 Btuh	301 CFM
Blow-thru fan sensible gain:	0 Btuh	
Total sensible gain on return side of coil:		0 Btuh
Total sensible gain on air handling system:		67,648 Btuh

Zone space latent gain:	6,983 Btuh	
Infiltration latent gain:	0 Btuh	
Outside air latent gain:	1,505 Btuh	
Total latent gain on air handling system:		8,488 Btuh
Total system sensible and latent gain:		76,136 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):	3,164 CFM
Total Air Handler Vent. Air (9.51% of Supply):	301 CFM
Total Conditioned Air Space:	1,886 Sq.ft
Supply Air Per Unit Area:	1.6776 CFM/Sq.ft
Area Per Cooling Capacity:	297.2581 Sq.ft/Ton
Cooling Capacity Per Area:	0.0034 Tons/Sq.ft
Total Heating Required With Outside Air:	32,658 Btuh
Total Cooling Required With Outside Air:	6.34 Tons



Air Handler #4 Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
12	Parent Observation/Party 102 10am September	559 35 5,590	6,408 460 0.82	23,898 1,167 2.09	17,456 0 0	Direct 460 460	Direct 460 460
	Zone Peak Totals:	559	6,408	23,898	17,456		
	Total Zones: 1	35	460	1,167	0	460	460
	Unique Zones: 1	5,590	0.82	2.09	0	460	460



Air Handler #4 Total Load Summary

Air Handler Description: **AHU-5** Constant Volume - Proportion
 Supply Air Fan: Draw-Thru with program estimated horsepower of 0.42 HP
 Fan Input: 65% motor and fan efficiency with 1.5 in. water across the fan
 Sensible Heat Ratio: 0.59 --- This system occurs 1 time(s) in the building. ---
 Air System Peak Time: 1pm in September.
 Outdoor Conditions: 95° DB, 74° WB, 96.95 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in September at 10am is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 23,898.

Summer: Ventilation controls outside air, ---- Winter: Ventilation controls outside air.

Zone Space sensible loss:	6,408 Btuh	
Infiltration sensible loss:	0 Btuh	0 CFM
Outside Air sensible loss:	24,141 Btuh	460 CFM
Supply Duct sensible loss:	0 Btuh	
Return Duct sensible loss:	0 Btuh	
Return Plenum sensible loss:	0 Btuh	
Total System sensible loss:		30,549 Btuh

Heating Supply Air: $6,408 / (.972 \times 1.08 \times 13) =$	460 CFM
Winter Vent Outside Air (100.0% of supply) =	460 CFM

Zone space sensible gain:	22,235 Btuh	
Infiltration sensible gain:	0 Btuh	
Draw-thru fan sensible gain:	1,045 Btuh	
Supply duct sensible gain:	0 Btuh	
Reserve sensible gain:	0 Btuh	
Total sensible gain on supply side of coil:		23,280 Btuh

Cooling Supply Air: $24,943 / (.972 \times 1.1 \times 20) =$	1,167 CFM
Summer Vent Outside Air (39.4% of supply) =	460 CFM

Return duct sensible gain:	0 Btuh	
Return plenum sensible gain:	0 Btuh	
Outside air sensible gain:	9,835 Btuh	460 CFM
Blow-thru fan sensible gain:	0 Btuh	
Total sensible gain on return side of coil:		9,835 Btuh
Total sensible gain on air handling system:		33,115 Btuh

Zone space latent gain:	17,456 Btuh	
Infiltration latent gain:	0 Btuh	
Outside air latent gain:	9,037 Btuh	
Total latent gain on air handling system:		26,494 Btuh
Total system sensible and latent gain:		59,608 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):	1,167 CFM
Total Air Handler Vent. Air (39.43% of Supply):	460 CFM
Total Conditioned Air Space:	559 Sq.ft
Supply Air Per Unit Area:	2.0869 CFM/Sq.ft
Area Per Cooling Capacity:	112.5343 Sq.ft/Ton
Cooling Capacity Per Area:	0.0089 Tons/Sq.ft
Total Heating Required With Outside Air:	30,549 Btuh
Total Cooling Required With Outside Air:	4.97 Tons



Air Handler #5 Summary Loads

Zn No	Description Peak Time	Area People Volume	Htg.Loss Htg.CFM CFM/Sqft	Sen.Gain Clg.CFM CFM/Sqft	Lat.Gain S.Exh W.Exh	Htg.O.A. Req.CFM Act.CFM	Clg.O.A. Req.CFM Act.CFM
13	Batting Cases 107 3pm August	12,245 100 293,880	34,459 2,000 0.16	106,987 5,223 0.43	49,875 0 0	Direct 2,000 2,000	Direct 2,000 2,000
	Zone Peak Totals:	12,245	34,459	106,987	49,875		
	Total Zones: 1	100	2,000	5,223	0	2,000	2,000
	Unique Zones: 1	293,880	0.16	0.43	0	2,000	2,000



Air Handler #5 Total Load Summary

Air Handler Description: **AHU-6 And AHU-7** Constant Volume - Proportion
 Supply Air Fan: Draw-Thru with program estimated horsepower of 1.90 HP
 Fan Input: 65% motor and fan efficiency with 1.5 in. water across the fan
 Sensible Heat Ratio: 0.69 --- This system occurs 1 time(s) in the building. ---

Air System Peak Time: 3pm in June.
 Outdoor Conditions: 99° DB, 75° WB, 95.93 grains

Because of the diversity in zone, plenum and ventilation loads, the zone sensible peak time in August at 3pm is different from the total system peak time, hence the air system CFM was computed using a zone sensible load of 106,987.

Summer: Ventilation controls outside air, ---- Winter: Ventilation controls outside air.

Zone Space sensible loss:	34,459 Btuh		
Infiltration sensible loss:	0 Btuh	0 CFM	
Outside Air sensible loss:	104,960 Btuh	2,000 CFM	
Supply Duct sensible loss:	0 Btuh		
Return Duct sensible loss:	0 Btuh		
Return Plenum sensible loss:	0 Btuh		
Total System sensible loss:			139,420 Btuh
Heating Supply Air: $34,459 / (.972 \times 1.08 \times 16) =$		2,000 CFM	
Winter Vent Outside Air (100.0% of supply) =		2,000 CFM	
Zone space sensible gain:	106,634 Btuh		
Infiltration sensible gain:	0 Btuh		
Draw-thru fan sensible gain:	4,677 Btuh		
Supply duct sensible gain:	0 Btuh		
Reserve sensible gain:	0 Btuh		
Total sensible gain on supply side of coil:			111,310 Btuh
Cooling Supply Air: $111,664 / (.972 \times 1.1 \times 20) =$		5,223 CFM	
Summer Vent Outside Air (38.3% of supply) =		2,000 CFM	
Return duct sensible gain:	0 Btuh		
Return plenum sensible gain:	0 Btuh		
Outside air sensible gain:	51,314 Btuh	2,000 CFM	
Blow-thru fan sensible gain:	0 Btuh		
Total sensible gain on return side of coil:			51,314 Btuh
Total sensible gain on air handling system:			162,624 Btuh
Zone space latent gain:	49,875 Btuh		
Infiltration latent gain:	0 Btuh		
Outside air latent gain:	38,847 Btuh		
Total latent gain on air handling system:			88,722 Btuh
Total system sensible and latent gain:			251,346 Btuh

Check Figures

Total Air Handler Supply Air (based on a 20° TD):	5,223 CFM
Total Air Handler Vent. Air (38.30% of Supply):	2,000 CFM
Total Conditioned Air Space:	12,245 Sq.ft
Supply Air Per Unit Area:	0.4265 CFM/Sq.ft
Area Per Cooling Capacity:	584.6117 Sq.ft/Ton
Cooling Capacity Per Area:	0.0017 Tons/Sq.ft
Total Heating Required With Outside Air:	139,420 Btuh
Total Cooling Required With Outside Air:	20.95 Tons