CITY OF LUCAS
CENTRAL FIRE STATION & ADMINISTRATION

PROJECT MANUAL

WIGINTON HOOKER JEFFRY PC

ARCHITECT

HALFF ASSOCIATES, INC.

CIVIL ENGINEER

HALFF ASSOCIATES, INC.

LANDSCAPE ARCHITECT

HALFF ASSOCIATES, INC.

STRUCTURAL ENGINEER

MD ENGINEERING LLP

MECHANICAL ELECTRICAL PLUMBING ENGINEER

HALL BUILDING INFORMATION GROUP LLC

SPECIFICATIONS CONSULTANT

May 14, 2014

DOCUMENT 00 0010
TABLE OF CONTENTS

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 – GENERAL REQUIREMENTS

DIVISION 03 - CONCRETE

DIVISION 04 – MASONRY

DIVISION 05 – METALS

DIVISION 06 – WOOD AND PLASTICS

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

DIVISION 08 – DOORS AND WINDOWS

DIVISION 09 – FINISHES

DIVISION 10 – SPECIALTIES

DIVISION 11 - EQUIPMENT

DIVISION 12 - FURNISHINGS

DIVISION 22 - PLUMBING

DIVISION 23 - HEATING VENTILATION AND AIR CONDITIONING

DIVISION 24 - ELECTRICAL

DIVISION 27 - COMMUNICATION SYSTEMS

DIVISION 31 - EARTHWORK

DIVISION 32 - EXTERIOR IMPROVEMENTS

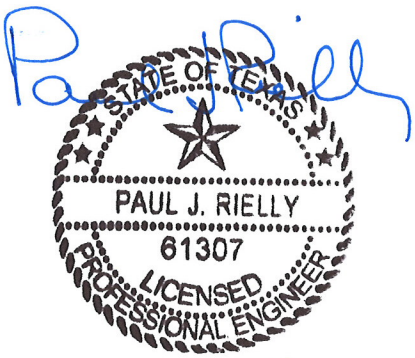
DIVISION 33 - UTILITIES

END OF DOCUMENT

HALFF

This seal, Paul J. Rielly PE # 61307, applies to the following specifications:

03 3000	Cast-in-Place Concrete
05 1200	Structural Steel Framing
05 3100	Steel Decking
05 4000	Cold-Formed Metal Framing
05 5000	Metal Fabrications
31 6329	Drilled Concrete Piers and Shafts



5.13.14

HALFF ASSOCIATES, INC.

1201 NORTH BOWSER ROAD
RICHARDSON, TX 75081-2275

TEL (214) 346-6200
FAX (214) 739-0095

WWW.HALFF.COM

THIS PAGE INTENTIONALLY BLANK

DIVISION 22 – PLUMBING - TABLE OF CONTENTS

DIVISION 23 – HEATING, VENTILATING AND AIR CONDITIONING (HVAC) - TABLE OF CONTENTS

DIVISION 26 & 27
TABLE OF CONTENTS

This seal, James S. R. Gaertner, PE, CFM # 104031, applies to the following specifications for the Lucas Fire Station:

22 1313 Facility Sanitary Sewer
31 1000 Temporary Erosion and Sediment Control During Construction
31 1100 Site Clearing & Grubbing
31 2000 Excavation, Backfill & Grading for Site Work Outside Building
32 1218 Excavation, Backfill & Compacting for Pavement
32 1216 Portland Cement Concrete Paving (Civil)
32 9200 Grass Seeding for Slope Protection & Erosion Control
33 220 Excavation, Backfill & Compacting for Utilities (Civil)
33 4100 Storm Drainage Pipe & Appurtenances

James Gaertner

05-14-14

THIS PAGE INTENTIONALLY BLANK

DOCUMENT 00 1119
NOTICE TO PROPOSERS

1. Competitive Sealed Proposals addressed to the City of Lucas (hereafter "Owner") Attention Kathy Wingo, City secretary who holds them until public bid opening. CSP'S will be received at the City Hall, Attention Kathy Wingo City Secretary, 665 Country Club Road, Lucas, Texas 75002, until **2:00 PM, on Thursday June 5, 2014,** for the following:

CSP FOR CENTRAL FIRE STATION ADDITION
CSP # 2014-06

At the above time and place the proposals will be publicly opened and read aloud and retained by the Owner for tabulation, checking and evaluation. Only the names of the respondent vendors will be read aloud. No other information will be disclosed.

A pre-proposal meeting will be held at City Hall, 665 Country Club Road, Lucas, Texas 75002 on Wednesday May 21, 2014 at 10:00 AM.

The Project consists of furnishing all labor, equipment and materials (except as otherwise specified), and performing all work necessary for the construction and installation of an approximately 10,000 sq. ft. addition to an existing facility to include site, utility and building construction. All fire lanes, and drive lanes shall be completed prior to the start of vertical construction. Items to be completed by owner:

a. Construction Material Testing
b. Commissioning / Air Balance Test
c. FFE (Fixtures, Furn., Equipment)
d. Washer/Dryer
e. Refrigerators
f. Data/IT/Radio/Technology
g. Landscaping/ Irrigation
h. Water Utility piping - All
i. Landscape and Domestic meter
j. Flag Poles
k. Fire Protection System - New & Existing
l. Fire Hydrant
m. Fire Alarm System - New & Existing
n. Apparatus Approach - Drainage Piping and Asphalt (existing only)
o. Emergency Generator and Transfer Switch
p. Screen wall & gates around Generator
q. Advertisement for Bidding
r. Final Plat

2. Proposals shall be submitted in sealed envelopes upon the blank form of the proposal furnished with the proposal packet. Sealed envelopes shall be marked **"CSP # 2014-06 CSP FOR CENTRAL FIRE STATION ADDITION – DO NOT OPEN UNTIL June 5th, 2014."**

3. A Bid Bond in the form of a cashier's check, a certified check, or an acceptable bidder's bond made payable without conditions to the City of Lucas in a amount of not less than five percent (5%) of the total amount of the proposal price submitted, must accompany each proposal as a guarantee that if awarded the contract, the vendor will promptly enter into a contract and execute such bonds as are required.

4. Plans and Specifications and contract documents may be examined without charge at the office

of the Architect, Wiginton Hooker Jeffry Architects, 500 North Central Expressway, Suite 300, Plano, Texas 75074.

Individual copies of the Plans and Specifications may be obtained from any D/FW area Thomas Reprographics for the cost of printing (Plus tax, Non-Refundable) by ordering online at http://public.constructionvaults.com or via phone at 469-341-1687 or via email at dallasvault@thomasrepro.com. No partial sets allowed.

5. The Owner reserves the right to accept the proposal which, in its judgment provides the best value to the Owner as follows:

   a. The project price; 40%
   b. The reputation of the proposer and the proposer's services; 10%
   c. The quality of the proposer's services; 5%
   d. The extent to which the proposer's services meets the Owner's needs; 5%
   e. The proposer's past performance on other similar projects; 5%
   f. The total long-term cost to the Owner to acquire the proposer's services; 5%
   g. The ability to meet the required schedule or finish earlier than the required schedule; 10%
   h. The owner reserves the right to reject all bids
   i. Other relevant factors as follows: the Owner prefers to select a proposer in which the firm and both the Project Manager and the onsite Construction Superintendent have served in their respective capacities on two successful completed facilities having similar components with a construction contract value of over $3,000,000; 20%

6. Proposals received after the specified time of closing will be returned unopened. Conditional or qualified proposals will not be accepted. No proposal may be withdrawn within **one hundred twenty (120)** days after the date on which proposals are opened.

7. The Owner requires that all questions relating to this CSP be directed in writing via email to Douglas Edney, Project Manager, at edneyd@whjarch.com. **No questions will be answered over the phone.**

   Requests for Substitution shall be submitted by **2:00pm (CST) on May 27, 2014**. Responses shall be issued by **2:00 pm (CST) on May 30, 2014**. Substitution Requests will only be accepted until the stated deadline.

   All other questions shall be submitted by 2:00pm (CST) on May 27, 2014. Questions will only be accepted until the stated deadline.

END OF DOCUMENT

DOCUMENT 00 2116
INSTRUCTIONS TO PROPOSERS

1. Respondents shall submit five (5) copies of responses to the "Respondent Questionnaire" portion and one (1) copy of the "Proposal" portion of Section 00 4100 – Proposal Form. Provide one (1) copy of any other documents that may be requested in this CSP. Each proposal shall be legibly written or printed in ink, on the proposal form provided in this bound copy of proposed Contract Documents. No alterations in proposal, or in the printed forms thereof, by erasures, interpolations, or otherwise will be considered unless each such alteration is signed or initialed by the proposer; if initialed, the Owner may require the proposer to identify any alterations so initialed. No alteration in any proposal, or in the proposal form on which it is submitted, shall be made by the person after the proposal has been submitted by the proposer. The proposer may withdraw his proposal any time prior to the proposal opening date and time stipulated in the Notice to Proposers.

   Each proposal shall be submitted in a sealed envelope upon the blank form of the proposal furnished. Sealed envelopes shall be marked **"CSP # 2014-06 CSP FOR CENTRAL FIRE STATION ADDITION – DO NOT OPEN UNTIL June 5, 2014."** The proposal must be addressed to the City of Lucas attention Kathy Wingo city secretary and identify the proposer. Proposals shall be delivered to the following address:

   City of Lucas
   Attention: Kathy Wingo
   City Hall
   665 Country Club Road
   Lucas, Texas 75002

   Proposals shall be submitted by 2:00 PM, on Thursday June 14, 2014, at such time proposals will be publicly opened and read aloud. **Facsimile Transmittals Will Not Be Accepted.** Only the names of the respondent vendors will be read aloud. No other information will be disclosed.

   All conforming proposals will be tabulated by the Owner. In the event variations exist between unit prices and extensions or totals shown in the Proposal, the unit prices shall govern. The Owner will determine the best value proposal, after considering the recommendations of the Architect, and award the contract.

2. Each Proposal shall be accompanied by either a cashier's check, a certified check, or an acceptable bid bond in an amount of not less than five percent (5%) of the total amount of the proposal price, make payable without conditions to City of Lucas, and the amount of the said Bid Bond may be retained by and forfeited to the Owner as liquidated damages if the proposal covered thereby is accepted and a contract based thereon is awarded and the proposer should fail to enter into a contract in the form prescribed, with legally responsible sureties, within the fifteen (15) days after receipt of such award is made by the Owner.

   The Bid Bond of the unsuccessful proposers will be returned if and when their proposals are rejected. The Bid Bond of the proposer to whom a contract is awarded will be returned provided the proposer executes a contract and files the required bonds and insurance. The Bid Bond of the second and third lowest responsible proposers may be retained for a period of not to exceed one hundred and twenty (120) days pending the execution of the contract and bonds by the successful proposer.

3. No pre-qualification of Proposers is required. However, to demonstrate qualifications to perform the work, each proposer shall furnish an experience list of similar work along with such other information as will tend to show the proposer's ability to prosecute the required work. This information should be submitted on the forms provided in this document. The Owner may make such investigations, as they deem necessary to determine the ability of the Proposer to perform the work.

4. Each proposer shall carefully examine the Plans, Specifications, and other Contract Documents, shall visit the site and fully inform himself of all conditions affecting the work or the cost thereof, and shall be presumed to have done so and his proposal shall be based upon his own conclusions from such examination. Each proposer shall inform himself concerning all Federal, State, and local laws, ordinances or regulations which may in any manner affect his proposed construction operations, or those engaged or employed on the work or the material or equipment. Should a proposer find discrepancies in or omissions from, the Plans, Specifications or other Contract Documents, he should at once notify the Architect and obtain clarification or interpretation prior to submitting any proposal.

   Any interpretation of the proposed Contract Documents will be made only by addendum duly issued and a copy of such addendum will be electronically transmitted to each plan holder from the Owner, or designated representative. The Owner will not be responsible for any other explanations or interpretations of the proposed Contract Documents. No information given by the Owner or any official thereof, other than that shown on the plans and contained in the specifications, proposal, addendum and other contract documents shall be binding on the Owner.

   Any proposer, by submitting his proposal, represents and warrants; that he has prepared his proposal in accordance with the contract documents, with full knowledge and understanding of the terms and provisions thereof; that he has reviewed, studied and examined the proposal prior to the signing and submission of same; and that he is cognizant of the terms of his proposal, verified his calculations and found them to be correct and agrees to be bound thereby.

5. The quantities of work and materials set forth in the proposal form or on the plans approximately represent the work to be performed and materials to be furnished, and are for the purpose of comparing proposals on a uniform basis. Payment shall be made to the Contractor only for the actual quantities of Work performed or material furnished in accordance with the plans and specifications; and it is understood that the quantities may be increased or decreased as hereinafter provided, without in any way invalidating the proposal prices.

6. The Owner may disqualify proposers and their proposal for any of the following specific reasons:
   a. Reasonable grounds for believing collusion exists among the proposers
   b. Reasonable grounds for believing that any proposer is interested in more than one proposal for the work contemplated
   c. The proposer having a history of filing fraudulent claims against the Owner, or against other contractors on a project of the Owner.
   d. The proposer or his surety having defaulted on a previous contract, or the proposer performed poorly on a previous contract.
   e. Lack of competency, skill, judgment, financial capability, integrity, reputation, reliability, or responsibility to perform the work as revealed by the proposal, proposal questionnaires, financial statement, performance history or other relevant information obtained by the Owner.
   f. Uncompleted work which, in the judgment of the Owner, shall prevent or hinder the prompt completion of additional work if awarded.
   g. Failure of the proposer to use the Owner's form of proposal bond in submitting his proposal.
   h. Unbalanced value of any proposal items.
   i. The proposer or his surety being currently in any litigation against the Owner, or where such litigation is contemplated or imminent, in the sole opinion of the Owner.

7. The proposer to whom a contract for the work is awarded will be required to furnish surety as follows:

   Performance Bond: A good and sufficient bond in an amount not less than one hundred percent (100%) of the total amount of the contract shall be filed with the Owner in accordance with the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS in the Contract Documents.

Payment Bond: A good and sufficient bond in an amount not less than one hundred percent (100%) of the total amount of the contract shall be filed with the Owner in accordance with the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS in the Contract Documents.

Maintenance Bond: A good and sufficient bond in an amount not less than fifteen percent (15%) of the total amount of the contract shall be filed with the Owner in accordance with the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS in the Contract Documents. The period of the Maintenance Bond shall be two years from the date of acceptance of all work done under the contract.

Certificates of Insurance: Satisfactory certificates of insurance shall be filed with the Owner in accordance with the GENERAL CONDITIONS and SUPPLEMENTARY CONDITIONS in the Contract Documents.

8. The Proposer's attention is directed to Texas House Bill 11, which amended the Texas Tax Code Section 151.311. The amendment provides that if a CONTRACTOR entering into a contract for the improvement of realty with an exempt entity, the CONTRACTOR will become a seller of materials purchased for the project, which will obviate paying taxes, on materials incorporated into the project. Services are not sales tax exempt.

9. No proposer may submit more than one proposal. Two proposals under different names will not be received from one firm or association.

10. A proposer may modify or withdraw his proposal at any time prior to the expiration of the period during which proposals may be submitted, by written request of the same persons or person who signed the Proposal.

11. None of the Instructions to Proposers, Proposal, Performance Bond, Payment Bond, Maintenance Bond, Contract Agreement, General Conditions, Special Conditions or Specifications shall be removed from the bound copy of the Contract Documents prior to filing the proposal contained therein.

12. Each proposer shall sign his proposal, using signature and giving his full business address. Proposals by partnerships shall be signed with the partnership name, followed by the signature of one of the members of the partnership, or by an authorized representative and designation of the person signing. Proposals by corporations shall be signed with the name of the corporation, followed by the signature and designation of the president, secretary, or other person authorized to bind it in the matter. The names of all persons signing should also be printed below the signature. A proposal by a person, who affixes to his signature the word "President", "Secretary, Agent", or other designation, without disclosing his principal, may be held to be an individual signing. When requested by the Owner, satisfactory evidence of the authority of the officer signing in behalf of a corporation shall be furnished.

13. The Notice of Award shall be accompanied by the necessary Contract Agreement and Bond Forms. The Proposer to whom the Contract is awarded will be required to execute the Contract Agreement and obtain the required Bonds and Certificates of Insurance within fifteen (15) calendar days from the date when Notice of Award is delivered to the proposer. In the case of failure of the proposer to execute the Contract Agreement, the Owner may at its option consider the proposer in default; in which case, the Bid Bond accompanying the Proposal will be forfeited.

14. The Owner, within fifteen (15) calendar days of receipt of acceptable Performance Bond, Payment Bond, Maintenance Bond, Certificates of Insurance and Contract Agreement signed by the proposer to whom the contract was awarded, shall sign the Contract Agreement and return to the proposer two (2) executed copied of the Contract Agreement. The Proposer may withdraw his signed Contract Agreements should the Owner fail to execute the Contract Agreement within the stated time period.

15. The Notice to Proceed shall be issued by the Owner within ten (10) days of the execution of the Contract Agreement by the Owner. The time may be extended by mutual agreement between the Owner and Contractor. If the Notice to Proceed has not been issued within the specified time or mutually agreed upon extension, the Contractor may terminate the Contract Agreement without further liability on the part of either party.

16. Not less that the federally determined prevailing wage rate, as issued by the U.S. Department of Labor, must be paid on this project or the prevailing wages for Collin County, Heavy Construction – published by the AGC of Texas, whichever is higher. A list of the worker's classifications and hourly rates is listed in the General Conditions. Proposers shall base their proposals on rates they expect to pay, if in excess of those listed. The Owner will not consider claims for extra payment on account of payment of wages higher than those required.

17. The Owner intends to award the Contract to a proposer that will be doing a substantial portion of the work rather than through subcontractors. The proposer must complete the item in the Proposal regarding the amount of work to be done by the Prime Contractor. The Owner reserves the right to consider this breakdown in awarding the Contract.

18. Each Proposer shall submit a list of all subcontractors they propose to use on this project for which the amount of the subcontract is in excess of $50,000. The Subcontractor List may be submitted with the PROPOSAL or, at the latest, prior to 2:00 PM, Friday, June 6, 2014 via email to Douglas Edney at EDNEYD@WHJARCH.COM. The list shall include the name and address of the subcontractor, the work they will be performing and the amount of the subcontract. The Owner reserves the right to request additional information as required for evaluation of subcontractors up to, and including, a Statement of Qualifications and Experience for each subcontractor listed. The Owner reserves the right to disapprove any subcontractor. The Contractor shall not change subcontractors or enter into contract with subcontractors not listed without prior approval by the Owner. The Owner reserves the right to refuse any or all requests for changes.

19. Proposal documents for this project include:
    a. This agreement
    b. Contract and Bond Forms
    c. Drawings
    d. Proposal
    e. The most current editions of the City of Lucas Ordinances and Codes
    f. *Standard Specifications for Public Works Construction – North Central Texas* (Fourth Edition – 2004 including all Amendments)
    g. *Occupational Safety and Health Standards – Excavation*, 20 CFR Part 1926
    h. *Texas Manual on Uniform Traffic control Devices (TMUTCD)*
    i. Certificate of Insurance
    j. General Conditions
    k. Supplementary Conditions
    l. Technical Specifications
    m. Texas Department of Transportation, Standard Specifications for Construction of Highways, Streets and Bridges, 2004 Edition.

END OF DOCUMENT

SECTION 00 2500
SUBSTITUTION PROCEDURES DURING BIDDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for substitutions during bidding period only. Substitutions will not be considered after the bidding period unless the product specified is no longer available.

1.2 DEFINITIONS

A. Substitutions: Changes proposed by Bidder for products, fabrication, or installation that differs from those indicated or specified by Contract Documents.

1.3 SUBMITTALS

A. Requests for Substitution: Identify specified work (product, fabrication, or installation) to be replaced by requested substitution.
   1. Substitution Request Form: Use form provided by Architect, a copy of which is at end of this Section.
   2. Documentation: Show compliance with requirements for substitutions and following, as applicable:
      a. Statement indicating why specified work (product, fabrication, or installation) cannot be provided.
      b. List of modifications necessary to accommodate requested substitution.
      c. Detailed comparison of significant qualities of requested substitution with those of specified work. Include annotated copy of applicable Specification Section. Significant qualities include, but not limited to, attributes such as performance, weight, size, durability, visual effect, energy conservation, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from specified work.
      d. Cost information, including a proposal of change, if any, in contract sum.
      e. Product data, including drawings and descriptions of products, fabrication, or installation procedures for both specified work and requested substitution.
      f. Samples, where applicable or requested.
      g. Certificates and qualification data, where applicable or requested.
      h. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, where applicable or requested.
      i. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated, where applicable or requested.
      j. Research reports evidencing compliance with building code in effect for Project, where applicable or requested.
   3. Architect's Action:
      a. If necessary, with reasonable promptness Architect will request additional information or documentation for evaluation.
      b. Architect will notify Bidder of acceptance or rejection of requested substitution with reasonable promptness.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Bidder Representations: Bidder certifies following about proposed substitution product if accepted:
   1. It has been investigated and determined to be equivalent or superior to specified work in all respects.
   2. Warranty will be equivalent or superior to warranty for specified work.
   3. It will have no adverse effect on related, associated, and adjacent work.
   4. It will have no adverse effect on dimensions and will not delay construction progress.
   5. Maintenance service and replacement parts are reasonably available.

6. Cost information included in request is complete and includes all related costs to integrate it into Work.
7. Claims for additional costs which may subsequently become apparent are waived.
8. Coordination, installation, and necessary changes in the Work will be complete in all respects.
9. It will function and perform same as specified work. Should requested substitution fail to function and perform as specified work, Bidder/Contractor shall remove requested substitution and install specified work at no additional cost to Owner.

PART 3 - EXECUTION (Not Used)

END OF SECTION

REQUEST FOR SUBSTITUTION DURING BIDDING

The undersigned Bidder requests consideration of the following request for substitution:

Date:

Project Name:

Specified Product:
Section Number:

Section Title:

Part, Article, Paragraph:

Description of specified work:

Requested Substitution: (Include product data and supplemental information as requested by the Architect)

Bidder's Acceptance:
The undersigned certifies the following is true and accurate, unless noted otherwise, about requested substitution if accepted:

1. It has been investigated and determined to be equivalent or superior to specified work in all respects.
2. Warranty will be equivalent or superior to warranty for specified work.
3. It will have no adverse effect on related, associated, and adjacent work.
4. It will have no adverse effect on dimensions and will not delay construction progress.
5. Maintenance service and replacement parts are reasonably available.
6. Cost information included in request is complete and includes all related costs to integrate it into Work.
7. Claims for additional costs which may subsequently become apparent are waived.
8. Coordination, installation, and necessary changes in the Work will be complete in all respects.
9. It will function and perform same as specified work. Should requested substitution fail to function and perform as specified work, Bidder/Contractor shall remove requested substitution and install specified work at no additional cost to Owner.

Change to bid proposal: $_____ [ ] Decrease [ ] Increase
Change to time: [ ] Adds _____ days [ ] Deletes _____ days [ ] Has no impact

_____ _____ _____
Bidder's name and signature date company

Architect's Action:

[ ] Recommends acceptance [ ] Does not recommend acceptance
[ ] Returned - Request does not comply with specified requirements

_____ _____ _____
Architect's name and signature date company

THIS PAGE INTENTIONALLY BLANK

DOCUMENT 00 3132
GEOTECHNICAL DATA

1.1 INVESTIGATION

A. Investigation: An investigation of subsurface soil conditions at the building site was authorized by the Owner, and investigations were made by Alpha Testing, Inc., Report No. G132036, dated December 18, 2013; and an addendum dated April 23, 2014.

1.2 REPORT

A. The complete report of the subsurface investigation is bound herein for information only.

B. Report and log of borings are bound herein for Contractor's information but is not a warranty of subsurface conditions, nor is it a part of the Contract Documents.

1.3 RESPONSIBILITY

A. Bidders are expected to examine the site and subsurface investigation reports and then decide for themselves the character of the materials to be encountered.

B. The Architect and Owner assume no responsibility for variations of subsoil quality of conditions.

END OF DOCUMENT

THIS PAGE INTENTIONALLY BLANK

GEOTECHNICAL EXPLORATION

on

LUCAS CENTRAL FIRE STATION
NWC of W. Lucas Road and Country Club Road
Lucas, Texas
ALPHA Report No. G132036

Prepared for:

WIGINTON HOOKER JEFFRY ARCHITECTS
500 North Central Expressway, Suite 300
Plano, Texas 75074
Attention: Mr. Douglas Edney
December 18, 2013

Prepared By:

ALPHA TESTING, INC.
2209 Wisconsin Street, Suite 100
Dallas, Texas 75229

ALPHA TESTING
WHERE IT ALL BEGINS

Geotechnical
Construction Materials
Environmental
TBPE Firm No. 813

2209 Wisconsin Street,
Suite 100
Dallas, Texas 75229

Tel: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

December 18, 2013

Wiginton Hooker Jeffry Architects
500 North Central Expressway, Suite 300
Plano, Texas 75074
Attention: Mr. Douglas Edney

Re: Geotechnical Exploration
Lucas Central Fire Station
NWC W. Lucas and Country Club Road
Lucas, Texas
ALPHA Report No. G132036

Attached is the report of the geotechnical exploration performed for the project referenced above. This study was authorized by Mr. Anthony M. Jeffry and performed in accordance with the Standard Form of Agreement between Wiginton Hooker Jeffry P.C. Architects, PC and ALPHA Testing, Inc. dated September 5, 2013.

This report contains results of field explorations and laboratory testing and an engineering interpretation of these with respect to available project characteristics. The results and analyses were used to develop recommendations to aid design and construction of foundations and new area pavement.

ALPHA TESTING, INC. appreciates the opportunity to be of service on this project. If we can be of further assistance, such as providing materials testing services during construction, please contact our office.

Sincerely,

ALPHA TESTING, INC.

Harsha Addula
Project Manager

STATE OF TEXAS
MARK L. McKAY
91067
LICENSED
PROFESSIONAL ENGINEER
12/18/13

Mark L. McKay , P.E.
Senior Geotechnical Engineer

HAR/MLM/mv
Copies: (1) Client

TABLE OF CONTENTS

On

ALPHA REPORT NO. G132036

1.0 PURPOSE AND SCOPE

The purpose of this geotechnical exploration is for ALPHA TESTING, INC. ("ALPHA") to evaluate for the "Client" some of the physical and engineering properties of subsurface materials at selected locations on the subject site with respect to formulation of appropriate geotechnical design parameters for the proposed new construction. The field exploration was accomplished by securing subsurface samples from widely spaced test borings performed across the expanse of the proposed construction site. Engineering analyses were performed from results of the field exploration and results of laboratory tests performed on representative samples.

Also included are general comments pertaining to reasonably anticipated construction problems and recommendations concerning earthwork and quality control testing during construction. This information can be used to evaluate subsurface conditions and to aid in ascertaining construction meets project specifications.

Recommendations provided in this report were developed from information obtained in test borings depicting subsurface conditions only at the specific boring locations and at the particular time designated on the logs. Subsurface conditions at other locations may differ from those observed at the boring locations, and subsurface conditions at boring locations may vary at different times of the year. The scope of work may not fully define the variability of subsurface materials and conditions that are present on the site.

The nature and extent of variations between borings may not become evident until construction. If significant variations then appear evident, our office should be contacted to re-evaluate our recommendations after performing on-site observations and possibly other tests.

2.0 PROJECT CHARACTERISTICS

It is proposed to construct a new building addition for living quarters and administration space at the existing Fire Station located at the northwest corner of West Lucas Road and Country Club Road (F.M. 1378) in Lucas, Texas. The proposed new building and the existing Fire Station will be connected along the north side of the existing Fire Station building. A site plan illustrating the general outline of the property is provided as Figure 1, the Boring Location Plan, in the Appendix of this report. At the time of the field exploration, an existing building was noted in the proposed new building area.

Present plans provide for the construction of a new building addition and associated parking and drive areas. The new structure is anticipated to create light to moderate loads to be carried by the foundation system. It is anticipated the new structure will be supported using a drilled pier foundation system. Based on the plans provide to us, it is our understanding the existing building is supported using drilled and under-reamed piers. New pavement will consist of Portland-cement concrete (PCC). Finished Floor for the new building is anticipated to be similar to the finished floor elevation of the existing Fire Station building and based on the current available information we have assumed earthwork to establish the new building pad grades could consist of cuts and fills of 1 ft or less.

3.0 FIELD EXPLORATION

Subsurface conditions on the site were explored by drilling a total of seven (7) test borings in general accordance with ASTM Standard D 420 using standard rotary drilling equipment. Borings 1, 2 and 3 were conducted in the footprint of the proposed building and were drilled to a depth of about 40 ft each. Borings P-1 through P-4 were drilled to a depth of 5 ft each in proposed pavement and/or drive areas. The approximate locations of the test borings are shown on the Boring Location Plan, Figure 1, enclosed in the Appendix of this report. Details of drilling and sampling operations are briefly summarized in Methods of Field Exploration, Section A-1 of the Appendix.

Subsurface types encountered during the field exploration are presented on Log of Boring sheets included in the Appendix of this report. The boring logs contain our Field Technician's and Engineer's interpretation of conditions believed to exist between actual samples retrieved. Therefore, these boring logs contain both factual and interpretive information. Lines delineating subsurface strata on the boring logs are approximate and the actual transition between strata may be gradual.

4.0 LABORATORY TESTS

Selected samples of the subsurface materials were tested in the laboratory to evaluate their engineering properties as a basis in providing recommendations for foundation design and earthwork construction. A brief description of testing procedures used in the laboratory can be found in Methods of Laboratory Testing, Section B-1 of the Appendix. Individual test results are presented on Log of Boring and summary data sheets enclosed in the Appendix.

5.0 GENERAL SUBSURFACE CONDITIONS

Based on available surface geology maps and our experience, the project site lies at the contact of the lower Taylor Marl (Ozan Formation) and Austin Chalk Formation. The Taylor Marl is composed of blocky structured clays and marl with some pyrite, phosphate nodules and limestone seams. Marl is generally present at greater depths. The Austin Chalk consists of massive blue-gray un-weathered limestone, overlain by tan weathered limestone. Near surface residuals soils associated with the Austin Chalk generally consist of high plasticity clays and/or moderate plasticity calcareous clays.

Subsurface materials in the borings generally consisted of clay (CH) to depths of about 4 to 6 ft underlain by silty clay (CL) and marl/shaly limestone in the deeper borings (Borings 1, 2 and 3) drilled in the proposed building. Gray marl (Shale) was encountered in Borings 1 and 2 at depths of about 32 ft and 31 ft, respectively and extended to the boring termination depth of 40 ft. Tan and gray shaly limestone was encountered in Boring 3 at a depth of about 22 ft and extended to a depth of 27 ft followed by gray shaly limestone to the boring termination depth of 40 ft. More detailed stratigraphic information is presented on the Log of Boring sheets attached to this report.

Most of the subsurface materials are relatively impermeable and are anticipated to have a relatively slow response to water movement. Therefore, several days of observation will be required to evaluate actual groundwater levels within the depths explored. Also, the groundwater level at the site is anticipated to fluctuate seasonally depending on the amount of rainfall, prevailing weather conditions and subsurface drainage characteristics.

During field explorations, free groundwater was not encountered on drilling tools or in open boreholes immediately upon completion of the borings. It is common to detect seasonal groundwater from natural fractures within the clayey matrix, near the soil/rock (marl/ shaly limestone) interface or from fractures in the rock, particularly during or after periods of precipitation. If more detailed groundwater information is required, monitoring wells or piezometers can be installed.

Further details concerning subsurface materials and conditions encountered can be obtained from the Log of Boring sheets provided in the Appendix of this report.

6.0 DESIGN RECOMMENDATIONS

The following design recommendations were developed on the basis of the previously described Project Characteristics (Section 2.0) and General Subsurface Conditions (Section 5.0). If project criteria should change, including building location on the site, our office should conduct a review to determine if modifications to the recommendations are required. Further, it is recommended our office be provided with a copy of the final plans and specifications for our review prior to construction.

The existing building north of the Fire Station will be removed prior to construction of the new building addition. Therefore, it is recommended any area disturbed during removal of the existing facilities be re-compacted in accordance with the recommendations provided in Section 7.3 of this report. All foundation elements of the existing facilities should be either removed or cut off at least 1 ft below finished grade or 1 ft below the new structural elements, whichever is deeper. All abandoned utility lines should be either removed or positively sealed to prevent possible water seepage into the subsurface clayey materials.

Differential movements can occur between the existing structure and the proposed building. Methods should be implemented to allow for possible differential performance between the foundations systems of the existing structure and the new building. Preventative measures should also be taken in order not to damage the integrity of the existing foundation system during construction of the new building.

The following design criteria given in this report were developed assuming the new building floor slab is constructed at the finished floor elevation similar to the existing slab elevation. Based on the current available information we have assumed earthwork to establish the new building pad grades could consist of cuts and fills of 1 ft or less. Further cutting or filling on the site beyond that assumed above can alter the recommended foundation design parameters. Therefore, it is recommended our office be contacted before performing other cutting and filling on site to verify the appropriate design parameters are utilized for final foundation design.

6.1 Drilled and Underreamed Pier Foundation System

Our findings indicate the structural frame and walls for the proposed new building could be supported using a system of drilled and underreamed piers. It is recommended these piers bear at a depth of at least 16 ft below final grade. Piers can be dimensioned using a net allowable end bearing pressure of 5 kips per sq ft and no skin friction component of resistance. The above bearing capacity contains a factor of safety of at least 3 considering a general bearing capacity failure. Normal elastic settlement of piers under loading is estimated to be less than about 1 inch.

Each pier shaft should be reinforced with suitable tension steel over its entire length to adequately resist potential uplift (tensile) forces due to potential soil swell (soil-to-pier adhesion) along the shaft, from post construction heave and other uplift forces applied by structural loadings. The magnitude of uplift adhesion due to soil swell along the pier shaft cannot be defined accurately and can vary according to the actual in-place moisture content of the soils during construction. It is estimated this uplift adhesion will not exceed about 1.75 kips per sq ft. This soil adhesion is approximated to act uniformly over the upper 12 ft of the pier shaft in contact with clayey soils. Uplift adhesion due to soil heave can be neglected over the portion of the pier shaft in contact with any select, non-expansive material.

The uplift force due to swelling of active clays should be resisted by the underreamed portion of the pier. The underreamed portion should be at least 2 and not exceeding 3 times the diameter of the shaft. The minimum clear spacing between edges of adjacent piers should be at least one (1) underream diameter.

All grade beams connecting piers should be formed and not cast in earthen trenches. Grade beams should be formed with a nominal 8-inch void at the bottom. Commercially available cardboard box forms (cartons) are made for this purpose. The cardboard cartons should extend the full length and width of the grade beams. Prior to concrete placement, the cartons should be inspected to verify they are firm, properly placed, and capable of supporting wet concrete. Some type of permanent soil retainer, such as pre-cast concrete panels, must be provided to prevent soils adjacent to grade beams from sloughing into the void space at the bottom of the grade beams. Additionally, backfill soils placed adjacent to grade beams must be compacted as outlined in Section 7.3 of this report.

6.2 Floor Slab

Based on the subsurface conditions encountered at the boring locations, the floor slab for the proposed building could experience soil-related potential seasonal movements on the order of about 4 inches. This potential seasonal movement was estimated in general accordance with methods outlined by Texas Department of Transportation (TxDOT) Test Method Tex-124-E, the results of swell tests, and engineering judgment and experience. Estimated movements were calculated assuming the moisture content of the in-situ soil within the normal zone of seasonal moisture content change varies between a "dry" condition and a "wet" condition as defined by Tex-124-E. Also, it was assumed a 1 psi

surcharge load from the floor slab acts on the subgrade soils. Movements exceeding those predicted above could occur if positive drainage of surface water is not maintained or if soils are subject to an outside water source, such as leakage from a utility line or subsurface moisture migration from off-site locations.

In view of these potential seasonal movements, the most positive floor system for the building is a slab suspended completely above the existing highly expansive soils. A 10-inch void space should be provided between the bottom of the slab (or lowest suspended fixture) and top surface of the underlying expansive clays.

A ventilated and drained crawl space is preferred for several reasons. 1) A crawl space can be properly drained, thus reducing the potential for water infiltration and differential soil movements. 2) Void cartons can collapse during construction, and a properly constructed crawl space can be inspected during and after construction to insure a proper void space is maintained. 3) Soil movements can cause damage to utilities, a crawl space provides access for utilities to be hung from the structure. 4) A crawl space provides access beneath the slab for future repairs or installation of new utility lines.

If some slab movement is tolerable (about 1 inch), the floor slab of the pier supported building can consist of a concrete slab designed to bear uniformly on improved soils. Due to the existing building, movement of subsurface soils could be reduced to about 1 inch by utilizing 7 ft of chemical injection in conjunction with placement of 2 ft of non-expansive material. *Due to the close proximity to the existing structure, the use of water pressure injection as a means of subgrade improvement is not recommended for this project.* In choosing this method of floor slab movement reduction, the Owner is accepting some post construction seasonal movement of the floor slab (1 inch).

A properly designed and constructed moisture barrier should be placed between the slab and subgrade soils to retard moisture migration through the slab.

Improvement Procedures:

1. Following removal of the necessary thickness of on-site expansive soils to allow for placement of at least 2 ft of non-expansive material, the exposed subgrade of the building pad should be chemical-injected to a depth of at least 7 ft below the bottom of the non-expansive fill. The injection process should extend throughout the entire building pad area and at least 5 ft beyond the exposed perimeter of the building. In entrance areas and adjoining flatwork, injection should extend at least 10 ft beyond the perimeter of the building.

2. Non-expansive material can consist of select material or flexible base material as described in Section 7.3 below. The select fill material should not extend beyond the building limits. If flatwork or paving is not planned adjacent to the structure (i.e. above the injected soils), a moisture barrier consisting of a minimum of 10 mil plastic sheeting with 8 to 12 inches of soil cover should be

provided above the injected soils. Injected soils should be maintained in a moist condition prior to placement of the required thickness of non-expansive material, plastic sheeting or flatwork.

Chemical injection is performed by injecting the clayey soils with a proprietary chemical specifically formulated for long-term reduction of shrink-swell capacity in expansive clayey soils. *The Client should obtain appropriate documentation from the manufacturer indicating the chemical is environmentally safe, long lasting and the injection process will not affect adjacent existing structures.* The injection contractor should provide references, and references should be obtained and verified. Also, chemical injection proposals should only be considered from injection contractors whose chemicals and processes have been shown to be effective through studies at major U.S. research universities.

Performance of post-injection swell testing and moisture content determinations should be employed as final acceptance criteria in engineering analysis to examine accomplishment of intended objectives of the injection treatment. Maximum benefit of these movement reduction procedures can be achieved by employing ALPHA TESTING, INC. to observe, monitor and test the entire process.

Satisfactory completion of the injection process is achieved when the desired moisture content and abatement of swell in the injected subgrade clay soils are reached. Acceptance criteria for injection should be based upon obtaining an average free swell of 1 percent or less in the injected zone. Performance of post-injection swell testing and moisture content determinations should be employed as final acceptance criteria in engineering analysis to examine accomplishment of intended objectives of the injection treatment.

The resulting estimated potential seasonal movements (about 1 inch) were calculated assuming the average free swell of the injected soils does not exceed 1 percent. Further, it is assumed the moisture content of the soil below the injected zone and within the normal zone of seasonal moisture content change varies between a "dry" condition and a "wet" condition as defined by Tex-124-E.

6.3 Flatwork

Flatwork, pavement and any other soil-supported structural elements will be subjected to the same level of movement as discussed in Section 6.2 (about 4 inches). If this level of movement is not acceptable, flatwork could be structurally supported on drilled pier foundations as described in Section 6.1 above. As an alternative, subgrade improvements as recommended in Section 6.2 could be considered for reduction in soil movements in any areas where post-construction movements would be critical.

6.4 Seismic Considerations

The Site Class for seismic design is based on several factors that include soil profile (soil or rock), shear wave velocity, and strength, averaged over a depth of 100 ft. Since our borings did not extend to 100-foot depths, we based our determinations on the assumption that the subsurface materials below the bottom of the borings were similar to those encountered at the termination depth of the borings. Based on Section 1613.3.2 of the 2012 International Building Code and Table 20.3-1 in the 2010 ASCE-7, we recommend using Site Class C (very dense soil and soft rock) for seismic design at this site.

6.5 Pavement

Clay encountered at the borings, or similar materials used as engineered fill for grading the site could be encountered as subgrade material for the parking and drive areas. These materials should be prepared prior to construction of pavements as recommended below in Section 7.1. To permit correlation between information from test borings and actual subgrade conditions exposed during construction, a qualified Geotechnical Engineer should be retained to provide subgrade monitoring and testing during construction. If there is any change in project criteria, the recommendations contained in this report should be reviewed by our office.

Calculations used to determine the required pavement thickness are based only on the physical and engineering properties of the materials and conventional thickness determination procedures. Pavement joining the buildings should be constructed with a curb and the joint between the building and curb should be sealed. Related civil design factors such as subgrade drainage, shoulder support, cross-sectional configurations, surface elevations, reinforcing steel, joint design and environmental factors will significantly affect the service life and must be included in preparation of the construction drawings and specifications, but were not included in the scope of this study. Normal periodic maintenance will be required for all pavements to achieve the design life of the pavement system.

Please note, the recommended pavement sections provided below are considered the minimum necessary to provide satisfactory performance based on the expected traffic loading. In some cases, City minimum standards for pavement section construction may exceed those provided below.

6.5.1 PCC Pavement Section

We recommend a minimum of 5 inches of adequately reinforced Portland cement concrete pavement for light-duty automobile traffic areas. A minimum of 6 inches of PCC is recommended in drive lanes, fire lanes, and areas subject to relatively light volume truck traffic, and 7 inches of PCC is recommended for dumpster areas and areas receiving moderate volume truck or fire truck traffic. Portland-cement concrete should have a minimum compressive strength of 3,000 lbs per sq inch (psi) at 28 days in light-duty traffic areas and 3,500 psi in drive lanes and

truck traffic areas. Concrete should be designed with 5 ± 1 percent entrained air. Joints in concrete paving should not exceed 15 ft. Reinforcing steel should consist of No. 3 bars placed at 18 inches on-center in two directions.

Lime treatment of the pavement subgrade is recommended for drive lanes, fire lanes, and pavement subject to truck traffic. Lime treatment of the pavement subgrade is not necessary for pavements subjected *exclusively* to passenger vehicle traffic, although lime treatment is these areas would be generally beneficial to the long-term performance of the pavement. Lime treatment of the subgrade is described in Section 6.5.2 below.

Alternately, lime-stabilization of the pavement subgrade could be eliminated by increasing the corresponding PCC thickness presented in the pavement sections above by 1 inch. Prior to construction of pavement on untreated clay subgrade soil, the exposed subgrade should be scarified to a depth of at least 6 inches and compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above the material's optimum moisture content.

6.5.2 Lime Treatment of Pavement Subgrade

Where lime-treatment is utilized, the exposed surface of the final pavement subgrade soil should be scarified to a depth of 6 inches and mixed with a minimum 7 percent hydrated lime (by dry soil weight) in conformance with TxDOT Standard Specifications Item 260. Assuming an in-place unit weight of 100 pcf for the pavement subgrade soils, this percentage of lime equates to about 32 lbs of lime per sq yard of treated subgrade. The actual amount of lime required should be confirmed by additional laboratory tests (ASTM C 977 Appendix XI) prior to construction. In all areas where hydrated lime is used to stabilize subgrade soil, routine Atterberg-limit tests should be performed to verify the resulting plasticity index of the soil-lime mixture is at/or below 15.

The soil-lime mixture should be compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 0 to 4 percentage points above the mixture's optimum moisture content.

Lime stabilization procedures should extend at least 1 ft beyond the edge of the pavement to reduce effects of seasonal shrinking and swelling upon the extreme edges of pavement. Lime stabilization of the pavement subgrade soil will not prevent normal seasonal movement of the underlying untreated materials. Pavement and other flat work will have the same potential for movement as slabs constructed directly on the existing undisturbed soils. Therefore, good perimeter surface drainage with a minimum slope of 2 percent away from the pavement is recommended. The use of sand as a leveling course below pavement and the use of an aggregate base course supported on expansive clays should be avoided. Normal maintenance of pavement should be expected over the life of the structures.

6.6 Drainage and Other Considerations

Adequate drainage should be provided to reduce seasonal variations in the moisture content of foundation soils. All pavement and sidewalks within 5 ft of the structures should be sloped away from the structures to prevent ponding of water around the foundations. Final grades within 5 ft of the structures should be adjusted to slope away from the structures at a minimum slope of 2 percent. **Maintaining positive surface drainage throughout the life of the structures is essential.**

In areas with pavement, sidewalks or other flatwork adjacent to the new structures, a positive seal must be maintained between the structures and the flatwork to minimize seepage of water into the underlying supporting soils. Post-construction movement of pavement and other flatwork is common. Normal maintenance should include examination of all joints in paving and sidewalks, etc. as well as resealing where necessary.

Several factors relate to civil and architectural design and/or maintenance, which can significantly affect future movements of the foundation and floor slab systems:

1. Preferably, a complete system of gutters and downspouts should carry runoff water a minimum of 5 feet from the completed structures.

2. Large trees and shrubs should not be allowed closer to the foundations than a horizontal distance equal to roughly one-half of their mature height due to their significant moisture demand upon maturing.

3. Moisture conditions should be maintained "constant" around the edge of the slabs. Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.

4. Planter box structures placed adjacent to buildings should be provided with a means to assure concentrations of water are not available to the subsoil stratigraphy.

5. Architectural design of the slab foundations should avoid additional features such as wing walls as extensions of the slabs.

Trench backfill for utilities should be properly placed and compacted as outlined in Section 7.3 of this report and in accordance with requirements of local municipal standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should not become a conduit and allow access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water from traveling in the trench backfill and entering beneath the structures.

7.0 GENERAL CONSTRUCTION PROCEDURES AND RECOMMENDATIONS

Variations in subsurface conditions could be encountered during construction. To permit correlation between test boring data and actual subsurface conditions encountered during construction, it is recommended a registered Professional Engineering firm be retained to observe construction procedures and materials.

Some construction problems, particularly degree or magnitude, cannot be reasonably anticipated until the course of construction. The recommendations offered in the following paragraphs are intended not to limit or preclude other conceivable solutions, but rather to provide our observations based on our experience and understanding of the project characteristics and subsurface conditions encountered in the borings.

7.1 Site Preparation and Grading

Care should be taken not to disturb or undermine the existing foundation system during construction of the new building.

All areas supporting floor slab, flatwork, pavement or areas to receive new fill should be properly prepared.

After completion of the necessary stripping, clearing, and excavating and prior to placing any required fill, the exposed soil subgrade should be carefully evaluated by probing and testing. Any undesirable material (organic material, wet, soft, or loose soil) still in place should be removed.

The exposed soil subgrade should be further evaluated by proof-rolling with a heavy pneumatic tired roller, loaded dump truck or similar equipment weighing approximately 20 tons to check for pockets of soft or loose material hidden beneath a thin crust of possibly better soil.

Proof-rolling procedures should be observed routinely by a Professional Engineer, or his designated representative.

Any undesirable material (organic material, wet, soft, or loose soil) exposed during the proofroll should be removed and replaced with well-compacted material as outlined in Section 7.3.

Prior to placement of any fill, the exposed soil subgrade should then be scarified to a minimum depth of 6 inches and recompacted as outlined in Section 7.3.

If fill is to be placed on existing slopes (natural or constructed) steeper than six horizontal to one vertical (6:1), the fill materials should be benched into the existing slopes in such a manner as to provide a minimum bench-key width of five (5) feet. This should provide a good contact between the existing soils and new fill materials, reduce potential sliding planes, and allow relatively horizontal lift placements.

Slope stability analysis of embankments (natural or constructed) was not within the scope of this study.

The contractor is responsible for designing any excavation slopes, temporary sheeting or shoring. Design of these structures should include any imposed surface surcharges. Construction site safety is the sole responsibility of the contractor, who shall also be solely responsible for the means, methods and sequencing of construction operations. The contractor should also be aware that slope height, slope inclination or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state and/or federal safety regulations, such as OSHA Health and Safety Standard for Excavations, 29 CFR Part 1926, or successor regulations. Stockpiles should be placed well away from the edge of the excavation and their heights should be controlled so they do not surcharge the sides of the excavation. Surface drainage should be carefully controlled to prevent flow of water over the slopes and/or into the excavations. Construction slopes should be closely observed for signs of mass movement, including tension cracks near the crest or bulging at the toe. If potential stability problems are observed, a geotechnical engineer should be contacted immediately. Shoring, bracing or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Texas.

Due to the nature of the clayey soils found near the surface at the borings, traffic of heavy equipment (including heavy compaction equipment) may create pumping and general deterioration of shallow soils. Therefore, some construction difficulties should be anticipated during periods when these soils are saturated.

7.2 Foundation Excavations

All foundation excavations should be monitored to verify foundations bear on suitable material. The bearing stratum exposed in the base of all foundation excavations should be protected against any detrimental change in conditions. Surface runoff water should be drained away from excavations and not allowed to collect. All concrete for foundations should be placed as soon as practical after the excavation is made. Drilled piers should be excavated and concrete placed the same day.

Prolonged exposure of the bearing surface to air or water will result in changes in strength and compressibility of the bearing stratum. Therefore, if delays occur, straight-shaft pier excavations should be slightly enlarged and deepened, or a new design penetration should be provided, in order to provide a fresh bearing surface.

All pier shafts should have a diameter such that the diameter to length ratio is at least 1 to 30 with a minimum shaft diameter of 1.5 ft for design purposes and to facilitate clean-out of the base and proper monitoring. Concrete placed in pier holes should be directed through a tremie, hopper, or equivalent. Placement of concrete should be vertical through the center of the shaft without hitting the sides of the pier or reinforcement to reduce the possibility of segregation of aggregates. Concrete placed in piers should have a minimum slump of 5 inches (but not greater than 7 inches) to avoid potential honey-combing.

Observations during pier drilling should include, but not necessarily be limited to, the following items:

Verification of proper bearing strata and consistency of subsurface stratification with regard to boring logs,

Confirmation the minimum required penetration into the bearing strata is achieved,

Complete removal of cuttings from bottom of pier holes,

Proper handling of any observed water seepage and sloughing of subsurface materials,

No more than 2 inches of standing water should be permitted in the bottom of pier holes prior to placing concrete, and

Verification of pier diameter, underream size, and steel reinforcement.

At the time the field exploration was performed, groundwater was not encountered in the borings. Based on our experience, shallower groundwater seepage could be encountered during pier installation, and the risk of encountering this seepage is increased during or after periods of precipitation. Temporary casing may be useful for controlling groundwater seepage that could occur in the clayey soils. As casing is extracted, care should be taken to maintain a positive head of plastic concrete and minimize the potential for intrusion of water seepage. It is recommended a separate bid item be provided for casing on the contractors' bid schedule. We should be contacted for further review and evaluation if groundwater seepage and/or underream collapse occurs during pier installation.

7.3 Fill Compaction

Select, Non-Expansive Fill: Materials used as select, non-expansive fill should have a liquid limit less than 35, a plasticity index (PI) not less than 5 nor greater than 15. All select, non-expansive fill should contain no deleterious material and should be compacted to a dry density of at least 98 percent standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content. (Note: The plasticity index and liquid limit of material used as select, non-expansive fill should be verified during fill placement using laboratory tests. Visual observation and classification should not be relied upon to confirm the material to be used as select, non-expansive fill satisfies the above Atterberg-limit criteria.). Atterberg-limits tests to verify the select, non-expansive fill shall be performed at a frequency of at least one test per every 2 ft (thick) per every 5,000 sq ft. Atterberg-limit tests shall be staggered between various lifts within each 5,000 sq ft.

Flexible Base Material: Flexible Base material used as non-expansive fill for the building pad area should meet the requirements of TxDOT Item 247, Type A, Grade 1 or 2. Processed concrete meeting TxDOT Item 247, Grade 1 or 2, Type D is also acceptable for as non-expansive material. The material should be compacted to a minimum 95 percent of standard Proctor maximum dry density (ASTM D 698) and within 3 percentage points of the material's optimum moisture content.

Clayey soils with a plasticity index equal to or greater than 25 should be compacted to a dry density between 93 and 98 percent of standard Proctor maximum dry density (ASTM D 698). The compacted moisture content of the clays during placement should be within the range of 2 to 4 percentage points above optimum.

Silty clay materials with a plasticity index below 25 should be compacted to a dry density of at least 95 percent of standard Proctor maximum dry density (ASTM D 698) and within the range of 1 percentage point below to 3 percentage points above the material's optimum moisture content.

Clayey materials used as fill should be processed and the largest particle or clod should be less than 6 inches prior to compaction.

Compaction should be accomplished by placing fill in about 8-inch thick loose lifts and compacting each lift to at least the specified minimum dry density. Field density and moisture content tests should be performed on each lift. As a guide, one test per 2,500 sq ft per lift is recommended in building areas. In larger site areas, a test frequency of one test per 5,000 sq ft or greater per lift may be used. Utility trench backfill should be tested at a rate of one test per lift per each 300 lineal feet of trench.

In cases where either mass fills or utility lines are more than 10 ft deep, the fill/backfill below 10 ft should be compacted to at least 98 percent of standard Proctor maximum dry density (ASTM D-698) and within 2 percentage points of the material's optimum moisture content. The portion of the fill/backfill shallower than 10 ft should be compacted as outlined above.

7.4 Groundwater

Groundwater was not encountered in the borings. From our experience, relatively shallow groundwater seepage may be encountered during excavation at this site for utilities, foundations, and other general excavations. The risk of seepage increases with depth of excavation and during or after periods of precipitation. Standard sump pits and pumping may be adequate to control seepage on a local basis. Where sump pits and pumping are not capable of controlling seepage, supplemental dewatering measures (such as, but not limited to, submersible pump in slotted casings and wellpoints) may be required.

In any areas where cuts made to establish final grades, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. In these areas subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other dewatering devices should be carefully addressed during construction. Our office could be contacted to visually observe final grades to evaluate the need for such drains.

8.0 LIMITATIONS

Professional services provided in this geotechnical exploration were performed, findings obtained, and recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. The scope of services provided herein does not include an environmental assessment of the site or investigation for the presence or absence of hazardous materials in the soil, surface water or groundwater. ALPHA, upon written request, can be retained to provide these services.

ALPHA TESTING, INC. is not responsible for conclusions, opinions or recommendations made by others based on this data. Information contained in this report is intended for the exclusive use of the Client (and their designated design representatives), and is related solely to design of the specific structures outlined in Section 2.0. No party other than the Client (and their designated design representatives) shall use or rely upon this report in any manner whatsoever unless such party shall have obtained ALPHA's written acceptance of such intended use. Any such third party using this report after obtaining ALPHA's written acceptance shall be bound by the limitations and limitations of liability contained herein, including ALPHA's liability being limited to the fee paid to it for this report. Recommendations presented in this report should not be used for design of any other structures except those specifically described in this report. In all areas of this report in which ALPHA may provide additional services if requested to do so in writing, it is presumed that such requests have not been made if not evidenced by a written document accepted by ALPHA. Further, subsurface conditions can change with passage of time. Recommendations contained herein are not considered applicable for an extended period of time after the completion date of this report. It is recommended our office be contacted for a review of the contents of this report for construction commencing more than one (1) year after completion of this report. Non-compliance with any of these requirements by the Client or anyone else shall release ALPHA from any liability resulting from the use of, or reliance upon, this report.

Recommendations provided in this report are based on our understanding of information provided by the Client about characteristics of the project. If the Client notes any deviation from the facts about project characteristics, our office should be contacted immediately since this may materially alter the recommendations. Further, ALPHA TESTING, INC. is not responsible for damages resulting from workmanship of designers or contractors. It is recommended the Owner retain qualified personnel, such as a Geotechnical Engineering firm, to verify construction is performed in accordance with plans and specifications.

APPENDIX

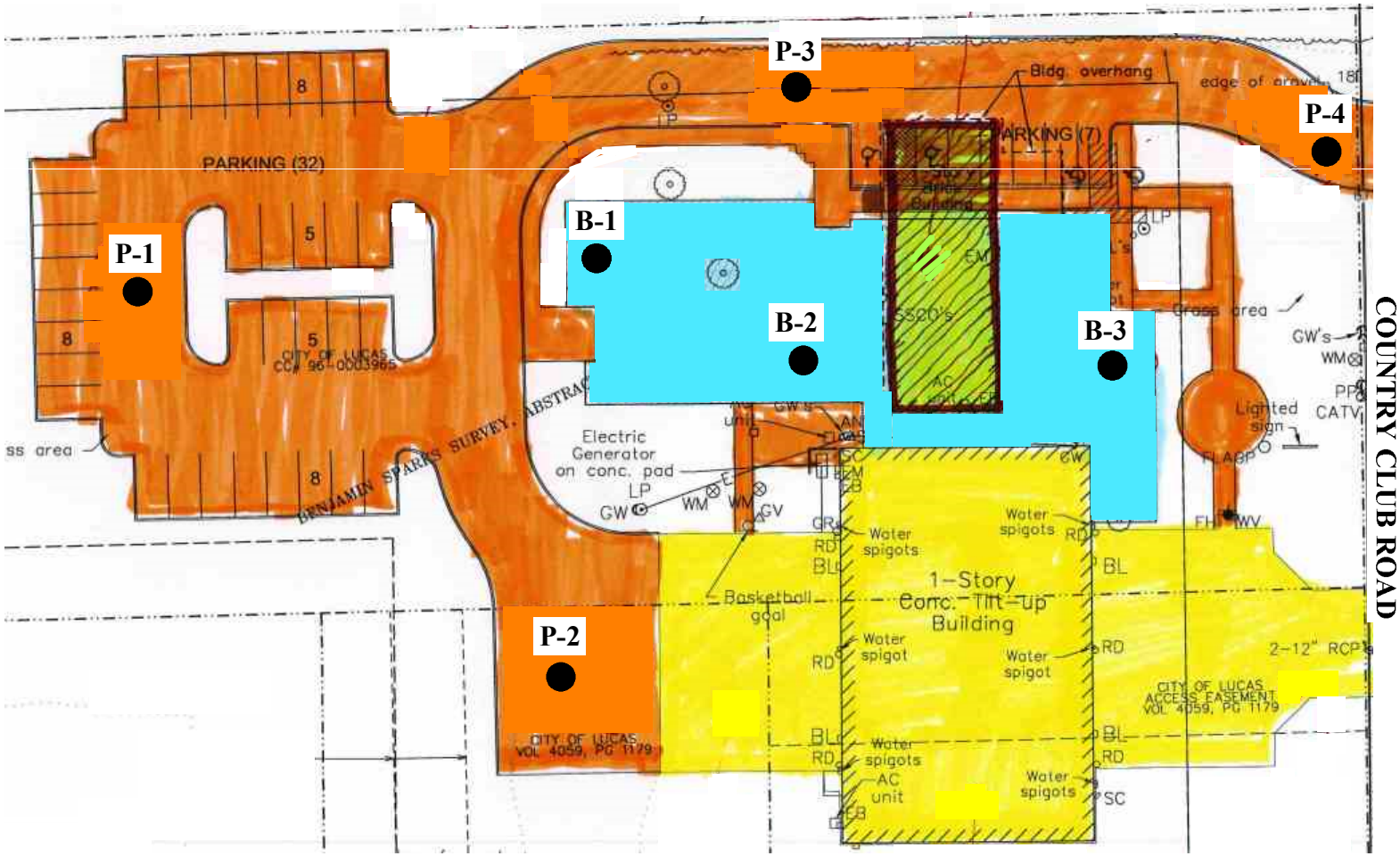
A-1 METHODS OF FIELD EXPLORATION

Using standard rotary drilling equipment, a total of seven (7) test borings were performed for this geotechnical exploration at the approximate locations shown on the Boring Location Plan, Figure 1. The test boring locations were staked by either pacing or taping and estimating right angles from landmarks which could be identified in the field and as shown on the site plan provided during this study. The location of the test borings shown on the Boring Location Plan is considered accurate only to the degree implied by the method used to locate the borings.

Relatively undisturbed samples of the cohesive subsurface materials were obtained by hydraulically pressing 3-inch O.D. thin-wall sampling tubes into the underlying soils at selected depths (ASTM D 1587). These samples were removed from the sampling tubes in the field and examined visually. A representative portion of each sample was sealed in a plastic bag for use in future visual examinations and possible testing in the laboratory.

The Texas Cone Penetration (TCP) test was used to assess the apparent in-place strength characteristics of the rock type materials. The TCP test consists of a 3-inch diameter steel cone driven by a 170-pound hammer dropped 24 inches (340 ft-pounds of energy) and is the basis for TxDOT strength correlations. Depending on the resistance (strength) of the materials, either the number of blows of the hammer required to provide 12 inches of penetration, or the inches of penetration of the cone due to 100 blows of the hammer are recorded on the field logs and are shown on the Log of Boring sheets as “TX Cone” (reference: TxDOT Test Method TEX 132-E).

Logs of all borings are included in the Appendix of this report. The logs show visual descriptions of subsurface strata encountered in the borings using the Unified Soil Classification System. Sampling information, pertinent field data, and field observations are also included. Samples not consumed by testing will be retained in our laboratory for at least 30 days and then discarded unless the Client requests otherwise.



● **Approximate Boring Locations**

Geotechnical Exploration
Lucas Central Fire Station
NWC of W. Lucas Road and Country Club Road
Lucas, Texas
Alpha Project No. G132036
December 18, 2013

ALPHA TESTING
WHERE IT ALL BEGINS

Boring Location Plan
Figure 1

B-1 METHODS OF LABORATORY TESTING

Representative samples were evaluated and classified by a qualified member of the Geotechnical Division and the boring logs were edited as necessary. To aid in classifying the subsurface materials and to determine the general engineering characteristics, natural moisture content tests (ASTM D 2216), Atterberg-limit tests (ASTM D 4318) and dry unit weight determinations were performed on selected samples. In addition, unconfined compression tests (ASTM D 2166) and pocket-penetrometer tests were conducted on selected soil samples to evaluate the soil shear strength. Results of all laboratory tests described above are provided on either the accompanying Log of Boring sheets or on summary data sheets as noted.

In addition to the Atterberg-limit tests, the expansive properties of some of the clay soils encountered were further analyzed by absorption swell tests. The swell test is performed by placing a selected sample in a consolidation machine and applying either the approximate current or expected overburden pressure and then allowing the sample to absorb water. When the sample exhibits very little tendency for further expansion, the height increase is recorded and the percent free swell and total moisture gain calculated. Results of the absorption swell test are provided on the Swell Test Data sheet, Figure 2 included in this appendix.

SWELL TEST DATA

Boring No.	1	2
Average Depth, ft	7	9
Liquid Limit	39	47
Plastic Limit	19	20
Plasticity Index	20	27
Initial Moisture Content	16%	18%
Final Moisture Content	20%	21%
Free Swell	0.0%	0.3%

Geotechnical Exploration
Lucas Central Fire Station
NWC of W. Lucas Rd. & Country Club Rd.
Lucas, Texas
Alpha Project No. G132036
December 18, 2013

ALPHA TESTING
WHERE IT ALL BEGINS

Swell Test Data
Figure 2

ALPHA TESTING
WHERE IT ALL BEGINS

2209 Wisconsin Street
Suite 100
Dallas, Texas
75229
Phone: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

LOG OF BORING NO.: B-1

PROJECT NO.: G132036

Client: Wiginton Hooker Jeffry Architects
Project: Lucas Central Fire Station
Start Date: 9/24/2013 **End Date:** 9/24/2013
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Lucas, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
On Rods (ft): None
After Drilling (ft): Dry
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
5		Dark Brown CLAY				4.5+							
						4.5+				18			
						4.5+				16			
		6.0											
		Tan and Gray SILTY CLAY with calcium deposits				4.5+				18	39	19	20
10						4.5+				16			
15						4.5+				19			
20						4.5+	7.9		108	21			
25		-gray below 25'				4.5+							
30						4.5+							
		32.0											
		Gray MARL with limestone layers			100/ 3.25"								
35													
					100/ 2"								
40		40.0											
		TEST BORING TERMINATED AT 40 FT											
45													

ALPHA TESTING
WHERE IT ALL BEGINS

2209 Wisconsin Street
Suite 100
Dallas, Texas
75229
Phone: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

LOG OF BORING NO.: B-2

PROJECT NO.: G132036

Client: Wiginton Hooker Jeffry Architects
Project: Lucas Central Fire Station
Start Date: 9/24/2013 **End Date:** 9/24/2013
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Lucas, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
On Rods (ft): None
After Drilling (ft): Dry
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAY with calcareous nodules				4.5+							
						4.5+				18	61	23	38
		4.0											
5		Tan and Gray SILTY CLAY with calcium deposits				4.5+				22			
						3.5				20			
10						4.5+				22	47	20	27
15						4.5+				18			
20						4.5+	10		107	21			
25						4.5+							
30						4.5+							
		31.0											
		Gray MARL with tan clay and limestone seams											
35					100/ 3.25"								
40		40.0			100/ 3.75"								
		TEST BORING TERMINATED AT 40 FT											
45													

ALPHA TESTING
WHERE IT ALL BEGINS

2209 Wisconsin Street
Suite 100
Dallas, Texas
75229
Phone: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

LOG OF BORING NO.: B-3

PROJECT NO.: G132036

Client: Wiginton Hooker Jeffry Architects
Project: Lucas Central Fire Station
Start Date: 9/24/2013 **End Date:** 9/24/2013
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Lucas, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
On Rods (ft): None
After Drilling (ft): Dry
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown and Tan CLAY with a trace of gravel - FILL				4.5+							
		2.0											
		Dark Brown CLAY with a trace of calcareous nodules				4.5+				18			
5		-brown below 4'				4.5+				20	58	22	36
		6.0											
		Tan and Gray SILTY CLAY with calcium deposits				3.0				22			
						4.25				17			
10													
15						4.5+				17	45	20	25
20						4.5+	11		124	12			
		22.0											
		Tan and Gray SHALY LIMESTONE with marl layers			100/ 2.5"								
25													
		27.0											
		Gray SHALY LIMESTONE with marl seams			100/ 2"								
30													
35					100/ 1.5"								
40		40.0			100/ 1.25"								
		TEST BORING TERMINATED AT 40 FT											
45													

ALPHA TESTING
WHERE IT ALL BEGINS

2209 Wisconsin Street
Suite 100
Dallas, Texas
75229
Phone: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

LOG OF BORING NO.: P-1
Sheet 1 of 1
PROJECT NO.: G132036

Client: Wiginton Hooker Jeffry Architects
Project: Lucas Central Fire Station
Start Date: 9/25/2013 **End Date:** 9/25/2013
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Lucas, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
On Rods (ft): None
After Drilling (ft): Dry
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Brown CLAY with a trace of calcareous nodules				4.5+				27	73	26	47
						4.5+				16			
5		-tan brown below 4' 5.0				4.5+							
		TEST BORING TERMINATED AT 5 FT											
10													
15													
20													
25													
30													
35													
40													
45													

ALPHA TESTING
WHERE IT ALL BEGINS

2209 Wisconsin Street
Suite 100
Dallas, Texas
75229
Phone: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

LOG OF BORING NO.: P-2

PROJECT NO.: G132036

Client: Wiginton Hooker Jeffry Architects
Project: Lucas Central Fire Station
Start Date: 9/25/2013 **End Date:** 9/25/2013
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Lucas, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
On Rods (ft): None
After Drilling (ft): Dry
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Dark Brown CALY with a trace of calcareous nodules				4.5+				24	67	24	43
		-brown below 2'				4.5+				25			
5		-tannish brown below 4' 5.0				4.5+							
		TEST BORING TERMINATED AT 5 FT											
10													
15													
20													
25													
30													
35													
40													
45													

ALPHA TESTING
WHERE IT ALL BEGINS

2209 Wisconsin Street
Suite 100
Dallas, Texas
75229
Phone: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

LOG OF BORING NO.: P-3

PROJECT NO.: G132036

Client: Wiginton Hooker Jeffry Architects
Project: Lucas Central Fire Station
Start Date: 9/25/2013 **End Date:** 9/25/2013
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Lucas, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
On Rods (ft): None
After Drilling (ft): Dry
After ____ Hours (ft):

Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Dark Brown CLAY with trace of calcareous nodules				4.5+				30			
		-brown below 2'				4.5+	1.5		89	17			
5		-tannish brown below 4' 5.0				4.5+							
		TEST BORING TERMINATED AT 5 FT											
10													
15													
20													
25													
30													
35													
40													
45													

ALPHA TESTING
WHERE IT ALL BEGINS

2209 Wisconsin Street
Suite 100
Dallas, Texas
75229
Phone: 972-620-8911
Fax: 972-620-1302
www.alphatesting.com

LOG OF BORING NO.: P-4

PROJECT NO.: G132036

Client: Wiginton Hooker Jeffry Architects
Project: Lucas Central Fire Station
Start Date: 9/25/2013 **End Date:** 9/25/2013
Drilling Method: CONTINUOUS FLIGHT AUGER

Location: Lucas, Texas
Surface Elevation:
West:
North:
Hammer Drop (lbs / in): 170 / 24

GROUND WATER OBSERVATIONS
▽ On Rods (ft): None
▼ After Drilling (ft): Dry
▼ After ____ Hours (ft):

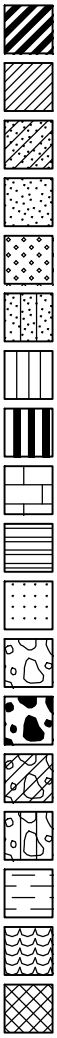
Depth, feet	Graphic Log	MATERIAL DESCRIPTION	Sample Type	Recovery % RQD	TX Cone or Std. Pen. (blows/ft,in)	Pocket Penetrometer (tsf)	Unconfined Comp. Strength (tsf)	% Passing No. 200 Sieve	Unit Dry Weight (pcf)	Water Content, %	Liquid Limit	Plastic Limit	Plasticity Index
		Dark Brown CLAY with a trace of calcareous nodules				4.5+				17			
		-brown below 2'				4.5+				16			
5		-tan and gray below 4' 5.0				4.5+							
		TEST BORING TERMINATED AT 5 FT											
10													
15													
20													
25													
30													
35													
40													
45													

ALPHA TESTING

WHERE IT ALL BEGINS

KEY TO SOIL SYMBOLS AND CLASSIFICATIONS

SOIL & ROCK SYMBOLS



(CH), High Plasticity CLAY

(CL), Low Plasticity CLAY

(SC), CLAYEY SAND

(SP), Poorly Graded SAND

(SW), Well Graded SAND

(SM), SILTY SAND

(ML), SILT

(MH), Elastic SILT

LIMESTONE

SHALE / MARL

SANDSTONE

(GP), Poorly Graded GRAVEL

(GW), Well Graded GRAVEL

(GC), CLAYEY GRAVEL

(GM), SILTY GRAVEL

(OL), ORGANIC SILT

(OH), ORGANIC CLAY

FILL

SAMPLING SYMBOLS

SHELBY TUBE (3" OD except where noted otherwise)

SPLIT SPOON (2" OD except where noted otherwise)

AUGER SAMPLE

TEXAS CONE PENETRATION

ROCK CORE (2" ID except where noted otherwise)

RELATIVE DENSITY OF COHESIONLESS SOILS (blows/ft)

VERY LOOSE	0 TO 4
LOOSE	5 TO 10
MEDIUM	11 TO 30
DENSE	31 TO 50
VERY DENSE	OVER 50

SHEAR STRENGTH OF COHESIVE SOILS (tsf)

VERY SOFT	LESS THAN 0.25
SOFT	0.25 TO 0.50
FIRM	0.50 TO 1.00
STIFF	1.00 TO 2.00
VERY STIFF	2.00 TO 4.00
HARD	OVER 4.00

RELATIVE DEGREE OF PLASTICITY (PI)

LOW	4 TO 15
MEDIUM	16 TO 25
HIGH	26 TO 35
VERY HIGH	OVER 35

RELATIVE PROPORTIONS (%)

TRACE	1 TO 10
LITTLE	11 TO 20
SOME	21 TO 35
AND	36 TO 50

PARTICLE SIZE IDENTIFICATION (DIAMETER)

BOULDERS	8.0" OR LARGER
COBBLES	3.0" TO 8.0"
COARSE GRAVEL	0.75" TO 3.0"
FINE GRAVEL	5.0 mm TO 3.0"
COURSE SAND	2.0 mm TO 5.0 mm
MEDIUM SAND	0.4 mm TO 5.0 mm
FINE SAND	0.07 mm TO 0.4 mm
SILT	0.002 mm TO 0.07 mm
CLAY	LESS THAN 0.002 mm

THIS PAGE INTENTIONALLY BLANK

ALPHA TESTING
WHERE IT ALL BEGINS

Geotechnical
Construction Materials
Environmental
TBPE Firm No. 813

2209 Wisconsin Street
Suite 100
Dallas, Texas 75229

Tel: 972.620.8911
Fax: 972.620.1302
www.alphatesting.com

April 23, 2014

Wiginton Hooker Jeffry Architects
500 North Central Expressway, Suite 300
Plano, Texas 75074
Attention: Mr. Douglas Edney

Re: Supplemental Design Parameters
Lucas Central Fire Station
NWC W. Lucas and Country Club Road
Lucas, Texas
ALPHA Report No. G132036-A

ALPHA TESTING, INC. recently performed a Geotechnical Exploration for the above referenced building as ALPHA Report No. G132036 dated December 18, 2013. Based on our conversations with the Client, it is contemplated to reduce potential movements of the proposed new building addition using exclusively non-expansive material. Potential seasonal movements could be reduced to the desired level using non-expansive material as described in more detail below.

The following information given in this supplemental report is based on information developed during the previous referenced Geotechnical Exploration. This letter should be considered an addendum to the referenced geotechnical report and should not be considered separately from that report.

Subgrade Improvement Utilizing Non-Expansive Material only

As previously reported, the floor slab for the proposed new building addition could experience soil-related potential seasonal movements on the order of about 4 inches.

Potential seasonal movements for the proposed new construction could be reduced to the desired level using non-expansive material only. Non-expansive material is described in Section 7.3 of the referenced report. The thickness of non-expansive material versus expected potential movement reduction is provided in Table A below.

TABLE A

Estimated Potential Movement, inches	Thickness of Non-Expansive Material, ft
4	0
2½	2
2	3
1½	4
1	5

In order to enhance performance of a slab underlain by select non-expansive fill at this site, every reasonable precaution must be taken to inhibit infiltration of groundwater and surface water into select fill. Past problems have occurred with slabs underlain by even extensive select fill thicknesses when poor drainage causes saturation of the select fill. In this instance, the select fill can act as a reservoir for water, and cause swelling beyond normally assumed amounts in the underlying clays. Therefore, it is recommended all backfill soils immediately adjacent to exterior grade beams consist of native clay soils compacted as outlined in Section 7.3 of the referenced report. Select, non-expansive fill should preferably not extend beyond building lines, except in major entrance areas. In areas where select fill extends beyond the building lines, a 1-ft thick layer of clayey type soil (material with a plasticity index of at least 30) compacted as recommended in Section 7.3 should be placed over the select fill to inhibit infiltration of surface water into the select fill and below the building.

Depending on the level of over-excavation along the existing building, the need for a shoring, under-pinning or other suitable type retention system should be evaluated by the project structural engineer before performing excavations adjacent to the existing building. Design and evaluation of retention systems are typically performed by specialty contractors. If additional geotechnical design parameters for retention systems are required, ALPHA should be contacted.

All other recommendations provided in the previous Geotechnical Exploration (i.e., ALPHA Report No. G132036 dated December 18, 2013) remain applicable for the proposed project.

ALPHA TESTING, INC. appreciates the opportunity to be of continued service on this project. If we can be of further assistance, please contact our office.

Sincerely,

ALPHA TESTING, INC.

Harsha Addula
Project Manager

STATE OF TEXAS
MARK L. McKAY
91067
LICENSED
PROFESSIONAL ENGINEER
4/24/14

Mark L. McKay, P.E.
Senior Geotechnical Engineer

HAR/MLM/pc
Copies: (1) Client

DOCUMENT 00 4100
PROPOSAL FORM

City of Lucas
Central Fire Station Addition

CSP # 2014-06

PROPOSAL

THIS BID IS SUBMITTED TO:

City of Lucas
Attention: Kathy Wingo
665 Country Club Road
Lucas, Texas 75002

The Undersigned Bidder proposes to complete the work as shown on the Plans and described in the specifications:

Unit Prices: Bidder hereby guarantees the following unit prices to apply throughout the project for changing work upon written instruction of the Owner.

No.	Description	Quantity	Unit	Unit Price	Extended Amount
	Excavated Soil:				
	Excavated Rock:				
	Un-cased Straight Shaft Pier: 18" diameter:				
	Un-cased Straight Shaft Pier: 24" diameter:				
	Un-cased Belled Pier: 18" diameter:				
	Steel Casing: 18" diameter:				
	Steel Casing: 24" diameter:				
	Additional Select Fill Installed				
	Duplex Electrical Outlet				
	Quad Electrical Outlet				
	Data Outlet				

Alternate Prices: Bidder hereby proposes the following alternate prices:

Alternate No. 1: DEDUCT $_____

TOTAL BASE BID: Bidder proposes to construct the Project for the stipulated sum of

_____**and 00/100 Dollars ($_____)**

TIME FOR SUBSTANTIAL COMPLETION **300 CALENDAR DAYS**

TIME FOR FINAL COMPLETION **330 CALENDAR DAYS**

1. The Bidder agrees that the Work will be Substantially Complete within the above number of calendar days after the date when the Contractor time commences to run and accepts the ($500.00) per day liquidated damages provision of the Supplementary Conditions, in the event of failure to obtain Substantial Completion within the specified time period. Substantial Completion is defined in the General Conditions in this document.

2. The Bidder agrees that the work will reach Final Completion within the above number of calendar days after the date when the contract time commences to run and accepts the ($500.00) per day liquidated damages provision of the Supplementary Conditions in the event of failure to reach Final Completion of the work within the specified time period.

3. The Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract Agreement with the Owner in the form included in the Contract Documents to complete all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contact Time indicated in this Bid and in accordance with the Contract Documents.

4. Bidder accepts all of the terms and conditions of the Notice to Bidders, including without limitation those dealing with the disposition of Proposal Guarantee. This Bid will remain open for one hundred twenty (120) days after the date of bid opening. The successful bidder will sign the Contract Agreement and submit the Contract Bonds, Certificate of Insurance and other documents required by the Contract Documents within fifteen (15) days after the date of Owner's Notice of Award.

5. In submitting this Bid, Bidder represents, as more fully set forth in the Contract Agreement, that:

   (a) Bidder has examined, and hereby acknowledges receipt of, copies of all the Contract Documents and the following addenda:

ADDENDUM NO:	DATE:
_____	_____
_____	_____
_____	_____

   (b) Bidder has examined the site and locality where the Work is to be performed, the legal requirements (Federal, State and local laws, ordinances, rules and regulations) and the conditions affecting cost, progress or performance of the Work and has made such independent investigations, as Bidder deems necessary.

   (c) Bidder intends to perform a substantial portion of the work himself in accordance with the following approximate breakdown based on percentage of Base Bid.

   Portion of Work by Bidder _____%
   Portion to be Sub-Contractor _____%

Subcontractor Information (List below or on attachment)

Name	Type of Work	Amount
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

6. The following documents are attached to and made a condition of this Bid:

   (a) Required Proposal Guarantee (cashier's check, certified check, or bid bond).
   (b) Statement of Bidder's Qualifications and Experience.

7. The terms used in this Bid which are defined in the General Conditions of the Contract Agreement included as part of the Contract Documents have the meaning assigned to then in the General Conditions.

Submitted on _____, 20__.

Individual
Partnership
Corporation

_____
Firm Name

By:_____
Typed or Printed

SIGNATURE_____

TITLE_____

ADDRESS_____

_____

_____

_____

TELEPHONE_____

CONTRACTOR_____

RESPONDENT QUESTIONNAIRE

Respondents are requested to submit a complete response to each of the below listed items. Responses requiring additional space should be brief and submitted as an attachment to the Respondent Questionnaire.

1. Legal name of the company:

   _____

   Address of office which would be providing service:

   _____

   _____

   Number of years in Business: _____

   Type of Operation: Individual: ___ Partnership: ___ Corporation: ___

   Number of Employees: _____

   Annual Sales Volume: _____

2. State whether you will provide a copy of your company's financial statements for the past two (2) years, if requested by the Owner.

3. Provide a Financial rating of your company and any documentation, including a Dunn and Bradstreet analysis, which indicates the financial stability of your company.

4. Is your company currently for sale or involved in any transaction to expand or to become acquired by another business entity? If yes, please explain the impact both in organizational and directional terms.

5. Provide any details of all past or pending litigation or claims filed against your company arising out of or in connection with your company's performance under a contract for construction management and/or construction services. Describe how such suit or claims were resolved.

6. Is your company currently in default on any loan agreement or financing agreement with any bank, financial institution, or other entity? If yes, specify date(s), details, circumstances, and prospects for resolution.

7. Does any relationship exist between your company and any of Owner's officers, employees or Architect whether by relative, business associate, capital funding agreement or any other such kinship? If yes, please explain.

8. What difficulties do you anticipate in serving the Owner and how do you plan to manage these? What assistance will you require from the Owner?

9. Describe your company's service support philosophy, how is it carried out, and how success in keeping this philosophy is measured.

10. Provide details regarding any special services or product characteristics, or other benefits offered, or advantages in the Owner selecting your company.

11. Describe your firm's past performance on other similar projects (e.g. cost control, cost savings, schedule control).

12. Describe your firm's demonstrated technical competence and management qualifications with construction contracting projects, particularly those for fire stations.

13. Describe the types of records, reports, monitoring systems, and information management systems which your firm used in the management of the projects listed above. Describe how you used these systems for three of the projects listed in response to item 16.

14. Describe your firm's management methodologies for the general contractor through sealed proposals project delivery system.

15. For three of the projects listed below in response to item 16, describe conflicts or potential conflicts with the Owner or with trade contractors, and describe the methods used to prevent and/or resolve those conflicts.

16. Provide a maximum of ten projects with photos for which your firm has provided/is providing construction services which are most related to this project. In determining which projects are most related, consider: same or related use of facilities (*i.e.* fire station); related size and complexity; whether the project consisted of an expansion of an existing facility or new construction; how many members of the proposed team (and their role) worked on the listed project; and, how recently the project was completed. List the projects in priority order, with the most related projects listed first.

17. For each of the listed projects, provide the following information: construction cost (original Bid and final construction cost), current phase of development, estimated (or past) completion date, type of construction services provided (CM at risk, CM-agency, design/build, general contractor-low bid, general contractor through sealed proposals), Owner's contact person and telephone number, and the name and telephone number of the project architect.

18. Describe your company's quality assurance program, what are your company's requirements, and how are they measured? For three of the projects listed in response to this Section, provide specific examples of how these techniques were used.

19. Provide customer reference letters from no less than three (3) public entities with which Respondent currently has contracts and/or has previously provided construction services of equal type and scope within the past five (5) years.

20. Describe the way in which your firm develops and maintains project schedules. How often do you update schedules? For three of the projects listed in response to this Section, provide examples of how these techniques were used. Include specific examples of scheduling challenges, and how your firm helped solve them.

21. Provide your company's safety Experience Modifier Rate (EMR), Recordable Incident Rate (RIR) and your Loss Indicator Rate (LIR).

22. Has your company, or any subcontractors under your control on a project, had a death on a project site. If yes, provide additional information.

END OF DOCUMENT

THIS PAGE INTENTIONALLY BLANK

DOCUMENT 00 4313
BID BOND

STATE OF TEXAS)
)
COUNTY OF COLLIN)

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____, whose address is _____ , hereinafter called Principal, and _____, a corporation organized and existing under the laws of the State of _____, and fully licensed to transact business in the State of Texas, as Surety, are held and firmly bound unto the City of Lucas, organized and existing under the laws of the State of Texas, hereinafter referred to as "Owner," in the penal sum of $_____as the proper measure of liquidated damages arising out of or connected with the submission of a Proposal for the construction of a public work project, in lawful money of the United States, to be paid in Collin County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors jointly and severally, firmly by these presents. The condition of the above obligation is such that whereas the Principal has submitted to Owner a certain Proposal, attached hereto and hereby made a part hereof, to enter into a contract in writing, for Central Fire Station Addition (the "Project").

NOW, THEREFORE, if the Principal's Proposal shall be rejected or, in the alternative, if the Principal's Proposal shall be accepted and the Principal shall execute and deliver a contract in the form of the Contract attached hereto (properly completed in accordance with said Proposal) and shall furnish performance, payment and maintenance bonds required by the Contract Documents for the Project and provide proof of all required insurance coverage's for the Project and shall in all other respects perform the agreement created by the acceptance of said Proposal, then this obligation shall be void, otherwise the same shall remain in force and affect; it being expressly understood and agreed that the liability of the Surety for any breech of condition hereunder shall be in the face amount of this bond and forfeited as a proper measure of liquidated damages.

PROVIDED FURTHER, that if any legal action were filed on this Bond, exclusive venue shall lie in Collin County, Texas.

AND PROVIDED FURTHER, the Surety, for value received, hereby stipulates and agrees that the obligations of said Surety and its bond shall be in no way impaired or affected by an extension of the time within which the Owner may accept such Proposal; and said Surety does hereby waive notice of any such extension.

The undersigned and designated agent is hereby designated by the Surety herein as the Resident Agent in Collin County or Dallas County to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of such suretyship, as provided by Article 7.19-1 of the Insurance Code, Vernon's Annotated Civil Statutes of the State of Texas.

IN WITNESS WHEREOF, this instrument is executed in _____ copies, each one of which shall be deemed an original, this, the _____ day of _____, 20____.

PRINCIPAL: _____

BY: _____
Name

ATTEST:

_____ TITLE: _____

SURETY: _____

BY: _____
Name

ATTEST:

_____ TITLE: _____

The Resident Agent of the Surety in Collin County or Dallas County, Texas, for delivery of notice and service of the process is:

NAME: _____
STREET ADDRESS: _____
CITY, STATE, ZIP: _____

NOTE: If Resident Agent is not a corporation, give a person's name.

IMPORTANT – Surety companies executing BONDS must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in the State of Texas.

END OF DOCUMENT

DOCUMENT 00 5213
CONTRACT FOR CONSTRUCTION

A. The Contract for Construction is the Standard city of Lucas contract for construction services, hereinafter referred to as the Contract, which follows this Document.

END OF DOCUMENT

THIS PAGE INTENTIONALLY BLANK

CITY OF LUCAS, TEXAS

PUBLIC WORKS CONSTRUCTION PROJECT

City of Lucas Central Fire Station Addition

CSP # 2014-06

Vendor name

TABLE OF CONTENTS

City of Lucas, Texas

This Agreement is made by and between the City of Lucas, Texas, a home-rule municipality (hereinafter referred to as the "City") and ***[ENTER CONTRACTOR LEGAL NAME]***, (hereinafter referred to as the "Contractor") for construction of City of Lucas Central Fire Station Addition (CSP # 2014-06), (hereinafter referred to as the "Project"), the City and the Contractor hereby agreeing as follows:

ARTICLE I

THE CONTRACT AND THE CONTRACT DOCUMENTS

1.1 THE CONTRACT

1.1.1 The contract between the City and the Contractor, of which this agreement (sometimes referred to herein as the "Contract") is a part, consists of the Contract Documents. It shall be effective on the date this Agreement is executed by the last party to execute it.

1.2. THE CONTRACT DOCUMENTS

1.2.1 The Contract Documents consist of this agreement, the General Conditions, the Special Conditions, the Invitation to Bid, Requirements and Instructions to Bidders, the Specifications, the Drawings, the Shop Drawings, the Project Manual, all Change Orders and Field Orders issued hereafter, the addenda, exhibits and attachments thereto, any other amendments hereto executed by the parties hereafter, together with the following (if any):

1.3 ENTIRE AGREEMENT

1.3.1 This Contract, together with the Contractor's performance and payment bonds for the Project, all General Conditions, Special Conditions, Plans and Specifications, and Addenda attached thereto, constitute the entire and exclusive agreement between the City and the Contractor with reference to the Project. Specifically, but without limitation, this Contract supersedes any bid documents and all prior written or oral communications, representations and negotiations, if any, between the City and Contractor not expressly made a part hereof.

1.4 NO PRIVITY WITH OTHERS

1.4.1 Nothing contained in this Contract shall create, or be interpreted to create, privity or any other contractual agreement between the City and any person or entity other than the Contractor.

1.5 INTENT AND INTERPRETATION

1.5.1 The intent of this Contract is to require complete, correct and timely execution of the Work. Any Work that may be required, implied or inferred by the Contract Documents, or any one or more of them, as necessary to produce the intended result shall be provided by the Contractor for the Contract Price.

1.5.2 This Contract is intended to be an integral whole and shall be interpreted as internally consistent. What is required by any one Contract Document shall be considered as required by the Contract.

1.5.3 When a word, term or phrase is used in this Contract, it shall be interpreted or construed, first, as defined herein; second, if not defined, according to its generally accepted meaning in the construction industry; and third, if there is no generally accepted meaning in the construction industry, according to its common and customary usage.

1.5.4 The word “City” includes the City of Lucas, Texas, a municipal corporation, and its public officials, officers, employees, agents and employees. The word “Contractor” includes the Contractor and its officers, employees, agents and representatives. The word "include", "includes", or "including", as used in this subparagraph and in this Contract, shall be deemed to be followed by the phrase, "without limitation".

1.5.5 The specification herein of any act, failure, refusal, omission, event, occurrence or condition as constituting a material breach of this Contract shall not imply that any other, non-specified act, failure, refusal, omission, event, occurrence or condition shall be deemed not to constitute a material breach of this Contract.

1.5.6 Words or terms used as nouns in this Contract shall be inclusive of their singular and plural forms, unless the context of their usage clearly requires a contrary meaning.

1.5.7 The Contractor shall have a continuing duty to read, carefully study and compare each of the Contract Documents, the Shop Drawings, the Product Data, and any Plans and Specifications, and shall give written notice to the City of any inconsistency, ambiguity, error or omission which the Contractor may discover with respect to these documents before proceeding with the affected Work. The issuance, or the express or implied approval by the City or the Engineer of the Contract Documents, Shop Drawings or Product Data, shall not relieve the Contractor of the continuing duties imposed hereby, nor shall any such approval be evidence of the Contractor's compliance with this Contract. The City has requested the Engineer to only prepare documents for the Project, including the Drawings, Plans and Specifications for the Project, which are accurate, adequate, consistent, coordinated and sufficient for construction. HOWEVER, THE CITY MAKES NO REPRESENTATION OR WARRANTY OF ANY NATURE WHATSOEVER TO THE CONTRACTOR CONCERNING SUCH DOCUMENTS. THE CONTRACTOR ASSUMES ALL RISK OF ERRORS, AMBIGUITIES AND INACCURACIES. By the execution hereof, the Contractor acknowledges and represents that it has received, reviewed and carefully examined such documents, has found them to be complete, accurate, adequate, consistent, coordinated and sufficient for construction, and that the Contractor has not, does not, and will not rely upon any representation or warranties by the City concerning such documents as no such representation or warranties have been or are hereby made. Further, the Contractor represents and warrants that it has had a sufficient opportunity to inspect the Project site and assumes any and all responsibility for inadequacies or ambiguities in the plans, drawings or specifications as well as for latent conditions of the site where the work is to be performed.

1.5.8 As between numbers and scaled measurements on the Drawings and in the Design, the numbers shall govern, as between larger scale and smaller scale drawings, the larger scale shall govern.

1.5.9 Neither the organization of any of the Contract Documents into divisions, sections, paragraphs, articles, (or other categories), nor the organization or arrangement of the Design, shall control the Contractor in dividing the Work or in establishing the extent or scope of the Work to be performed by Subcontractors.

1.6 OWNERSHIP OF CONTRACT DOCUMENTS

1.6.1 The Contract Documents, and each of them individually and collectively, shall remain the property of the City. The Contractor shall have the right to keep one record set of the Contract Documents upon completion of the Project; provided, however, that in no event shall Contractor use, or permit to be used, any or all of such Contract Documents on other projects without the City's prior written authorization.

ARTICLE II

THE WORK

2.1 The Contractor shall perform all of the Work required, implied or reasonably inferable from this Contract.

2.2 WORK

2.2.1 The term "Work" shall mean whatever is done by or required of the Contractor to perform and complete its duties under this Contract, including the following: construction of the whole or a designated part of the Project; furnishing of any required surety bonds and insurance, and the provision or furnishing of labor, supervision, services, materials, supplies, equipment, fixtures, appliances, facilities, tools, transportation, storage, permits and licenses required of the Contractor, power, water, fuel, heat, light, cooling and all other utilities as required by this Contract. The Work to be performed by the Contractor is generally described as follows:

Approximate quantities for City of Lucas Central Fire Station Addition (CSP # 2014-06) include ***[ENTER MAJOR BID ITEMS AND QUANTITIES]***; and other miscellaneous improvements as shown on the plans and in accordance with the specifications.

2.2.2 The Contractor shall be responsible for paying for and procuring all materials and labor and furnishing all services necessary or appropriate for the full performance of the Work and the for the full completion of the Project. All materials shall be new and materials and workmanship shall be of good quality. Upon request, the Contractor shall furnish satisfactory proof of the type, kind, and quality of materials.

ARTICLE III

CONTRACT TIME

3.1 SUBSTANTIAL COMPLETION

3.1.1 "Substantial Completion" shall mean that stage in the progression of the Work when the Work is sufficiently complete in accordance with this Contract that the City can enjoy beneficial use or occupancy of the Work and can utilize the Work for its intended purpose, even though minor miscellaneous work and/or adjustment may be required.

3.2 TIME

3.2.1 The Contractor shall commence the Work within 10 days of receipt of a written Notice to Proceed, and shall achieve Substantial Completion of the Work no later than **300 calendar days** from the date specified in the Notice to Proceed. The term “calendar days” shall mean any and all days of the week or month, no days being excepted. The number of calendar days from the date on which the Work is permitted to proceed, through the date set forth for Substantial Completion, shall constitute the Contract Time” and the “scheduled completion date.” The execution of this Contract by the Contractor constitutes an agreement that adequate time has been allotted for this Contract, given the Contract Price.

3.2.2 Work may proceed on any day of the week, including weekends, and at any time of the day. However, work shall not occur on such days or at such times as, in the City’s or Engineer’s discretion, may be a violation of noise or environmental regulations or ordinances, or when the presence of workers, equipment or materials may create an abnormally hazardous condition.

3.2.3 The Contractor shall submit and comply with construction schedules establishing completion timelines and deadlines for each component of the Project. Construction schedules shall be submitted to and approved by the Engineer and the City on a regular basis as required by the Contract Documents. If no reference is made to construction schedules in the Contract Documents, then construction schedules shall be submitted with each Application for Payment.

3.3 TIME IS OF THE ESSENCE

3.3.1 The scheduled completion date is based on public necessity. The scheduled completion date is factored into and is a material component of the Contract Price. All limitations of time set forth in the Contract Documents are of the essence of this Contract.

3.3.2 TIME IS OF THE ESSENCE IN THE PERFORMANCE OF THE WORK AND THE COMPLETION OF THE PROJECT ON OR BEFORE THE SCHEDULED COMPLETION DATE. THE SCHEDULED COMPLETION DATE IS A DEADLINE. THE CITY EMPLOYS A ZERO-TOLERANCE POLICY REGARDING THE TIME FOR COMPLETION. The time for completion is an essential and material term of this Contract and the Contractor's failure to achieve substantial completion on the date stated herein, to comply with work schedules, or achieve milestones in approved construction schedules, shall be a material breach and default of this Contract.

3.3.3 The City will assess liquidated damages for late or untimely performance and may, at the City's sole option, elect to allow Contractor to continue with the Work, or may declare Contractor to be in breach and default of the Contract and order Contractor to remove all equipment and personnel from the work site. All remedies for Contractor's late performance shall be nonexclusive and cumulative without waiver of any other, and the City's election of one shall not preclude the City from pursuing any other.

3.3.4 It is contemplated by the parties that the progress of the Work may be delayed by certain conditions beyond the control of the parties; these delays have been contemplated by the parties and considered in the time allotted for performance specified herein and in the contract price and includes, but is not limited to delays occasioned on account of adverse weather, temporary unavailability of materials, shipment delays, and the presence and potential interference of other contractors or of utilities that may be performing work at the Project site unrelated to this Contract. These delays have been considered and included in the determination of the scheduled completion date and the Contract Price.

3.4 LIQUIDATED DAMAGES

3.4.1 The Contractor shall pay the City the sum of **$200.00** per day for each and every calendar day of unexcused delay in achieving Substantial Completion beyond the date set forth herein for Substantial Completion of the Work. Any sums due and payable hereunder by the Contractor shall be payable, not as a penalty, but as liquidated damages representing an estimate of delay damages likely to be sustained by the City, estimated at or before the time of executing this Contract. When the City reasonably believes that Substantial Completion will be inexcusably delayed, the City shall be entitled, but not required, to withhold from any amounts otherwise due the Contractor an amount then believed by the City to be adequate to recover liquidated damages applicable to such delays. If and when the Contractor overcomes the delay in achieving Substantial Completion, or any part thereof, for which the City has withheld payment, the City shall promptly release to the Contractor those funds withheld, but no longer applicable, as liquidated damages. If the Contractor has submitted a Statement of Delay with the appropriate Application for Payment as required by Subparagraph 5.2.3, and/or has complied with the notice and Change Order requirements of this Contract, the Engineer shall have sole discretion to determine whether a delay is excused or unexcused and the Engineer's determination thereof shall be final and binding on the parties.

3.5 NO DAMAGES FOR DELAY; NO BACK-CHARGES; DAMAGE WAIVER

3.5.1 No claim shall be made by the Contractor to the City, and no damages, costs or extra compensation shall be allowed or paid by the City to the Contractor for any delay or hindrance from any cause in the progress or completion of the Work or this Contract. The Contractor's sole remedy in the event of any delay or hindrance, regardless of cause, shall be to request time extensions by written change orders as provided for hereinafter. The failure to seek or obtain a change order for time extension shall be deemed a waiver thereof and Contractor shall be regarded as having made a determination that the delay will not affect the completion of the Work. Should the Contractor be delayed by an act of the City, or should the City order a stoppage of the Work for sufficient cause unrelated to any act or omission of the Contractor, an extension of time shall be granted by the City by Change Order upon written application, which extension shall not be unreasonably denied, to compensate for the delay.

3.5.2 The City shall have the authority to suspend the Work wholly or in part for such period or periods of time as it may deem appropriate due to unsuitable conditions considered unfavorable for the proper prosecution of the Work or for the failure of the Contractor to carry out instructions from the City or City's representative. During any period in which the Work is stopped or during which any of the Work is not actively in progress for any reason, Contractor shall properly protect the site and the Work from damage, loss or harm. The Contractor shall not be compensated for periods of delay caused by a suspension of the work by the City. If work is suspended due to unsuitable conditions through no fault of the Contractor, an extension of time shall be granted by the City by Change Order upon written application, which extension shall not be unreasonably denied, to compensate for the delay.

3.5.3 The Contractor shall not have or assert any claim against the City for damages or back-charges of any kind for any reason, including but not limited to claims for Extra Work, damages, economic loss, additional costs, unknown latent site conditions, and refusals by the City to grant extensions of time, unless supported and authorized by a written Change Order or separate agreement signed by all parties. The Contractor, in entering into this Contract, hereby waives, releases, quitclaims, discharges and holds harmless the City from and against any and all claims, damages, liabilities and losses, save and except those arising under Paragraph 12.1 of this Contract.

ARTICLE IV

CONTRACT PRICE

4.1 THE CONTRACT PRICE

4.1.1 The City shall pay, and the Contractor shall accept, as full and complete payment for all of the Work required herein, the fixed sum of

$[ENTER CONTRACT AMOUNT].

The sum set forth in this Paragraph 4.1 shall constitute the Contract Price which shall not be modified except by written Change Order as provided in this Contract, or the assessment of liquidated damages.

ARTICLE V

PAYMENT OF THE CONTRACT PRICE

5.1 SCHEDULE OF VALUES

5.1.1 The Schedule of Values, submitted to and accepted by the City and Engineer at the time of the Contractor's bid, allocates the Contract Price to the various portions of the Work. The Contractor's Schedule of Values shall have been be prepared, or at the City's or Engineer's request shall be amended prior to the commencement of construction, in such form, with such detail, and supported by such data as the Engineer or the City may require to substantiate its accuracy. The Contractor shall not imbalance its Schedule of Values nor artificially inflate any element thereof. The violation of this provision by the Contractor shall constitute a material breach of this Contract. The Schedule of Values shall be used only as a basis for the Contractor's Applications for Payment and shall only constitute such basis after it has been acknowledged and accepted in writing by the Engineer and the City.

5.2 PAYMENT PROCEDURE

5.2.1 The City shall pay the Contract Price to the Contractor as provided below.

5.2.2 PROGRESS PAYMENTS - Based upon the Contractor's Applications for Payment submitted to the Engineer and upon Certificates for Payment subsequently issued to the City by the Engineer, the City shall make progress payments to the Contractor on account of the Contract Price.

5.2.3 APPLICATION FOR PAYMENT - On or before the 25th day of each month after commencement of the Work, the Contractor shall submit an Application for Payment for the period ending the 15th day of the month to the Engineer in such form and manner, and with such supporting data and content, as the City or the Engineer may require. The Contractor may request payment for that portion of the Contract Price properly allocable to Contract requirements properly provided and to labor, materials and equipment properly incorporated in the Work, less retainage and less the total amount of previous payments received from the City. Such Application for Payment shall be signed by the Contractor and shall constitute the Contractor's representation that the Work has progressed to the level for which payment is requested in accordance with the Schedule of Values, that the Work has been properly installed or performed in full compliance with this Contract, and that the Contractor knows of no reason why payment should not be made as requested. Thereafter, the Engineer will review the Application for Payment and may also review the Work at the Project site or elsewhere to determine whether the quantity and quality of the Work is as represented in the Application for Payment and is as required by this Contract. The Engineer shall determine and certify to the City the amount properly owing to the Contractor. The City shall make partial payments on account of the Contract Price to the Contractor within thirty (30) days following the Engineer's receipt and approval of each Application for Payment. The amount of each partial payment shall be the amount certified for payment by the Engineer less such amounts, if any, otherwise owing by the Contractor to the City or which the City shall have the right to withhold as authorized by this Contract. The Engineer's certification of the Contractor's Application for Payment shall not preclude the City from the exercise of any of its rights as set forth in Paragraph 5.3 hereinbelow.

5.2.4 STATEMENT OF DELAY - Each Application for Payment shall include a Statement of Delay showing the number of days lost due to inclement weather, conflicts with other City contractors, utilities, or design specifications, or other proper reasons. The failure to submit the Statement of Delay shall be a waiver of any claim for additional days or extensions of the scheduled completion date.

5.2.5 RETAINAGE - The City shall withhold retainage of ten (10) percent from each progress payment to secure performance of the Contract and shall deposit in an interest-bearing account that portion of the retainage withheld that exceeds five (5) percent of the progress payment. If a different percentage is set forth in the Invitation to Bid, then that percentage shall apply.

5.2.6 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the City when installed at the Project site, regardless of the time of payment. The Contractor further warrants that upon submittal of an Application for Payment, all Work for which payments have been received from the City shall be free and clear of liens, claims, security interest or other encumbrances in favor of the Contractor or any other person or entity whatsoever.

5.2.7 The Contractor shall promptly pay each Subcontractor out of the amount paid to the Contractor on account of such Subcontractor's Work, the amount to which such Subcontractor is entitled. In the event the City becomes informed that the Contractor has not paid a Subcontractor as herein provided, the City shall have the right, but not the duty, to issue future checks in payment to the Contractor of amounts otherwise due hereunder naming the Contractor and such Subcontractor as joint payees. Such joint check procedure, if employed by the City, shall create no rights in favor of any person or entity beyond the right of the named payees to payment of the check and shall not be deemed to commit the City to repeat the procedure in the future.

5.2.8 No progress payment, nor any use or occupancy of the Project by the City, shall be interpreted to constitute an acceptance of any Work not in strict compliance with this Contract.

5.3 WITHHELD PAYMENT

5.3.1 The City may decline to make payment, may withhold funds, and, if necessary, may demand the return of some or all of the amounts previously paid to the Contractor, to protect the City from loss because of:

(a) defective Work not remedied by the Contractor or, in the opinion of the City, likely to be remedied by the Contractor;

(b) claims of third parties against the City or the City's property;

(c) failure by the Contractor to pay Subcontractors or others in a prompt and proper fashion;

(d) evidence that the balance of the Work cannot be completed in accordance with the Contract for the unpaid balance of the Contract Price,

(e) evidence that the Work will not be completed in the time required for substantial or final completion (final completion meaning the full and final completion of all work called for by this Contract and final acceptance by the Engineer and the City);

(f) persistent failure to carry out the Work in accordance with the Contract;

(g) damage to the City or a third party to whom the City is, or may be, liable.

(h) failure to submit an updated project schedule in accordance with Subparagraph 3.2.3.

(i) failure to submit record drawings in accordance with Subparagraph 7.9.1.

In the event that the City makes written demand upon the Contractor for amounts previously paid by the City as contemplated in this Subparagraph 5.3.1, the Contractor shall promptly comply with such demand. The City shall have no duty to third parties to withhold payment to the Contractor and shall incur no liability for a failure to withhold funds.

5.4 UNEXCUSED FAILURE TO PAY

5.4.1 If within twenty (20) days after the date established herein for payment to the Contractor by the City, the City, without cause or basis hereunder, fails to pay the Contractor any amount then due and payable to the Contractor, then the Contractor may after ten (10) additional days' written notice to the City and the Engineer, and without prejudice to any other available rights or remedies it may have, stop the Work until payment of those amounts due from the City have been received. Late payments shall not accrue interest or other late charges.

5.5 CERTIFICATE OF SUBSTANTIAL COMPLETION

5.5.1 When the Contractor believes that the Work is substantially complete, the Contractor shall submit to the Engineer a list of items to be completed or corrected. When the Engineer and the City on the basis of an inspection determine that the Work is in fact substantially complete, the Engineer will prepare a Certificate of Substantial Completion which shall establish the date of Substantial Completion, shall state the responsibilities of the City and the Contractor for Project security, maintenance, heat, utilities, damage to the Work, and insurance, and shall fix the time within which the Contractor shall complete the items listed therein. In no event, however, shall the date of Final Completion be delayed. Guarantees required by the Contract shall commence on the date of Substantial Completion of the Work; however, the maintenance bond required herein, and the assurances given thereunder, shall commence of and from the date of final acceptance of the work by the City. The Certificate of Substantial Completion shall be submitted to the City and the Contractor for their written acceptance of the responsibilities assigned to them in such certificate.

Upon Substantial Completion of the Work, and execution by both the City and the Contractor of the Certificate of Substantial Completion, the City shall pay the Contractor for all work completed to date, less retainage.

5.6 COMPLETION AND FINAL PAYMENT

5.6.1 When all of the Work is finally complete and the Contractor is ready for a final inspection, it shall notify the City and the Engineer thereof in writing. Thereupon, the Engineer will make final inspection of the Work and, if the Work is complete in full accordance with this Contract and this Contract has been fully performed, the Engineer will promptly issue a final Certificate for Payment certifying to the City that the Project is complete and the

Contractor is entitled to the remainder of the unpaid Contract Price (including retainage and the interest accrued on the retainage in excess of five (5) percent), less any amount withheld pursuant to this Contract. If the Engineer is unable to issue its final Certificate for Payment and is required to repeat its final inspection of the Work, the Contractor shall bear the cost of such repeat final inspection(s) which cost may be deducted by the City from the Contractor's final payment.

5.6.1.1 If the Contractor fails to achieve final completion within the time fixed therefor by the Engineer in its Certificate of Substantial Completion, the Contractor shall pay the City the sum set forth hereinabove as liquidated damages per day for each and every calendar day of unexcused delay in achieving final completion beyond the date set forth herein for final completion of the Work. Any sums due and payable hereunder by the Contractor shall be payable, not as a penalty, but as liquidated damages representing an estimate of delay damages likely to be sustained by the City, estimated at or before the time of executing this Contract. When the City reasonably believes that final completion will be inexcusably delayed, the City shall be entitled, but not required, to withhold from any amounts otherwise due the Contractor an amount then believed by the City to be adequate to recover liquidated damages applicable to such delays. If and when the Contractor overcomes the delay in achieving final completion, or any part thereof, for which the City has withheld payment, the City shall promptly release to the Contractor those funds withheld, but no longer applicable, as liquidated damages. Liquidated damages shall be deducted from any sums otherwise due to the Contractor.

5.6.2 The Contractor shall not be entitled to final payment unless and until it submits to the Engineer its affidavit that all payrolls, invoices for materials and equipment, and other liabilities connected with the Work for which the City, or the City's property might be responsible, have been fully paid or otherwise satisfied; releases and waivers of lien from all Subcontractors of the Contractor and of any and all other parties required by the Engineer or the City; consent of Surety, if any, to final payment. If any third party fails or refuses to provide a release of claim or waiver of lien as required by the City, the Contractor shall furnish a bond satisfactory to the City to discharge any such lien or indemnify the City from liability.

5.6.3 The City shall make final payment of all sums due the Contractor within thirty (30) days of the Engineer's execution of a final Certificate for Payment.

5.6.4 Acceptance of final payment shall constitute a waiver of all claims against the City by the Contractor except for those claims previously made in writing against the City by the Contractor, pending at the time of final payment, and identified in writing by the Contractor as unsettled at the time of its request for final payment.

5.6.5 Other than interest on retainage in excess of 5% under Paragraph 5.2.5, under no circumstances shall Contractor be entitled to receive interest on any payments or monies due Contractor by the City, whether the amount on which the interest may accrue is timely, late, wrongfully withheld, or an assessment of damages of any kind.

ARTICLE VI

THE CITY

6.1 INFORMATION, SERVICES AND THINGS REQUIRED FROM CITY

6.1.1 The City shall furnish to the Contractor, at the time of executing this Contract, any and all written and tangible material in its possession concerning conditions below ground at the site of the Project. Such written and tangible material is furnished to the Contractor only in order to make complete disclosure of such material and for no other purpose. By furnishing such material, the City does not represent, warrant, or guarantee its accuracy either in whole, in part, implicitly or explicitly, or at all, and shall have no liability therefor. The City shall also furnish surveys, legal limitations and utility locations (if known), and a legal description of the Project site.

6.1.2 Excluding permits and fees normally the responsibility of the Contractor, the City shall obtain all approvals, easements, and the like required for construction and shall pay for necessary assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

6.1.3 The City shall furnish the Contractor, free of charge, two copies of the Contract Documents for execution of the Work.

6.2 RIGHT TO STOP WORK

6.2.1 If the Contractor persistently fails or refuses to perform the Work in accordance with this Contract, if the Contractor fails to meet milestones set forth in approved construction schedules, if the City has sufficient reason to believe that the Contractor is not and will not complete the Project by the scheduled completion date, or if the best interests of the public health, safety or welfare so require, the City may order the Contractor to stop the Work, or any described portion thereof, until the cause for stoppage has been corrected, no longer exists, or the City orders that Work be resumed. In such event, the Contractor shall immediately obey such order.

6.3 CITY'S RIGHT TO PERFORM WORK

6.3.1 If the Contractor's Work is stopped by the City under Paragraph 6.2, and the Contractor fails within seven (7) days of such stoppage to provide adequate assurance to the City that the cause of such stoppage will be eliminated or corrected, then the City may, without prejudice to any other rights or remedies the City may have against the Contractor, proceed to carry out the subject Work. In such a situation, an appropriate Change Order shall be issued deducting from the Contract Price the cost of correcting the subject deficiencies, plus compensation for the Engineer's additional services and expenses necessitated thereby, if any. If the unpaid portion of the Contract Price is insufficient to cover the amount due the City, the Contractor shall pay the difference to the City.

ARTICLE VII

THE CONTRACTOR

7.1 MUST FOLLOW CONTRACT

7.1.1 The Contractor shall perform no part of the Work at any time without adequate Contract Documents or, as appropriate, approved Shop Drawings, Product Data or Samples for such portion of the Work. If the Contractor performs any of the Work knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Engineer, the Contractor shall bear responsibility for such performance and shall bear the cost of correction. The Contractor shall perform the Work strictly in accordance with this Contract

7.2 PROSECUTION OF WORK

7.3.1 The Contractor shall supervise and direct the Work using the Contractor's best skill, effort and attention. The Contractor shall be responsible to the City for any and all acts or omissions of the Contractor, its employees and others engaged in the Work on behalf of the Contractor.

7.3.2 The Contractor shall give adequate attention to the faithful prosecution of the Work and the timely completion of this Contract, with authority to determine the manner and means of performing such Work, so long as such methods insure timely completion and proper performance.

7.3.3 The Contractor shall exercise all appropriate means and measures to insure a safe and secure jobsite in order to avoid and prevent injury, damage or loss to persons or property.

7.3.4 The City will not interfere with the Contractor’s manner and means of performing the Work. However, the City’s insistence on strict compliance with the Contract shall not be regarded as an interference with the

Contractor's manner and means. In the event that any part of the Work is not in strict compliance with the Contract, the Contractor is and shall be estopped from claiming any interference by the City or Engineer with the Contractor's manner and means of performing that part of the Work.

7.4 WARRANTY

7.4.1 The Contractor warrants to the City that all labor furnished to progress the Work under this Contract will be competent to perform the tasks undertaken, that the product of such labor will yield only first-class results, that materials and equipment furnished will be of good quality and new unless otherwise permitted by this Contract, and that the Work will be of good quality, free from faults and defects and in strict conformance with this Contract. All Work not conforming to these requirements may be considered defective. THE CONTRACTOR WARRANTS AND GUARANTIES THAT IT SHALL COMPLETE THE WORK AND ACHIEVE SUBSTANTIAL COMPLETION BY THE SCHEDULED COMPLETION DATE, STRICTLY IN ACCORDANCE WITH THIS CONTRACT. DEFECTIVE WORK OR MATERIALS SHALL BE FIXED, REPAIRED OR REPLACED FREE OF CHARGE OR COST TO THE CITY.

7.5 PERMITS; FEES; LICENSES

The Contractor shall obtain and pay for all permits, fees and licenses necessary and ordinary for the Work. The Contractor shall comply with all lawful requirements applicable to the Work and shall give and maintain any and all notices required by applicable law pertaining to the Work.

7.6 SUPERVISION

7.6.1 The Contractor shall employ and maintain at the Project site only competent supervisory personnel. Absent written instruction from the Contractor to the contrary, the superintendent shall be deemed the Contractor's authorized representative at the site and shall be authorized to receive and accept any and all communications from the City or the Engineer.

7.6.2 Key supervisory personnel assigned by the Contractor to this Project are as follows:

NAME	FUNCTION
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

So long as the individuals named above remain actively employed or retained by the Contractor, they shall perform the functions indicated next to their names unless the City agrees to the contrary in writing. In the event one or more individuals not listed above subsequently assume one or more of those functions listed above, the Contractor shall be bound by the provisions of this Subparagraph 7.6.2 as though such individuals had been listed above.

7.7 WORK SCHEDULE

7.7.1 At the pre-construction meeting, the Contractor shall submit to the City and the Engineer for their information, the Contractor's schedule for completing the Work (also referred to herein as the construction schedule). The Contractor's schedule shall be revised no less frequently than monthly (unless the parties otherwise agree in writing) and shall be revised to reflect conditions encountered from time to time and shall be related to the entire Project. Each such revision shall be furnished to the City and the Engineer.

7.7.2 The Contractor's schedule for completing the Work and any revised schedules, shall demonstrate achievement of substantial completion by the scheduled completion date. Failure by the Contractor to strictly comply with the provisions of this Paragraph 7.7 shall constitute a default and a material breach of this Contract.

7.8 ON-SITE DRAWINGS

7.8.1 The Contractor shall continuously maintain at the site, for the benefit of the City and the Engineer, one record copy of this Contract marked to record on a current basis changes, selections and modifications made during construction. Additionally, the Contractor shall maintain at the site for the City and Engineer the approved Shop Drawings, Product Data, Samples and other similar required submittals. Upon final completion of the Work, all of these record documents shall be delivered to the City.

7.9 RECORD DRAWINGS/PLANS, AS-BUILT PLANS, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

7.9.1 The Contractor shall submit, with each Application for Payment, As-Built plans for any and each part or portion of the Project that varies from the Engineer's plans and specifications and the Contract Documents.

7.9.2 Shop Drawings, Product Data, Samples and other submittals from the Contractor do not constitute Contract Documents. Their purpose is merely to demonstrate the manner in which the Contractor intends to implement the Work in conformance with information received from the Contract Documents.

7.9.3 The Contractor shall not perform any portion of the Work requiring submittal and review of Shop Drawings, Product Data or Samples unless and until such submittal shall have been approved by the Engineer. Approval by the Engineer, however, shall not be evidence that Work installed pursuant thereto conforms to the requirements of this Contract.

7.10 CLEANING THE SITE AND THE PROJECT

7.10.1 The Contractor shall keep the site reasonably clean during performance of the Work. The Contractor shall clean the site and the Project and remove all waste, rubbish, temporary structures, and other materials during construction and, upon completion of construction, shall clean the site and remove all such material together with all of the Contractor's property therefrom. Contractor shall dispose of all refuse at a landfill approved by the Texas Commission on Environmental Quality. The Contractor shall further restore all property damaged during the prosecution of the Work and shall leave the site in a clean and presentable condition. No additional payment shall be made by the City for this work, the compensation having been considered and included in the contract price.

7.11 ACCESS TO WORK AND INSPECTIONS

7.11.1 The City and the Engineer shall have access to the Work at all times from commencement of the Work through final completion. The Contractor shall take whatever steps necessary to provide access when requested. When reasonably requested by the City or the Engineer, the Contractor shall perform or cause to be performed such testing as may be necessary or appropriate to insure suitability of the jobsite or the Work's compliance with the Contract requirements.

7.12 INDEMNITY AND DISCLAIMER

7.12.1 CITY SHALL NOT BE LIABLE OR RESPONSIBLE FOR, AND SHALL BE INDEMNIFIED, DEFENDED, HELD HARMLESS AND RELEASED BY CONTRACTOR FROM AND AGAINST ANY AND ALL SUITS, ACTIONS, LOSSES, DAMAGES, CLAIMS, OR LIABILITY OF ANY CHARACTER, TYPE, OR DESCRIPTION, INCLUDING ALL EXPENSES OF LITIGATION, COURT COSTS, AND ATTORNEY'S FEES, FOR INJURY OR DEATH TO ANY PERSON, INJURY OR LOSS TO ANY PROPERTY, OR ECONOMIC LOSS, RECEIVED OR SUSTAINED BY ANY PERSON OR PERSONS, INCLUDING THE CONTRACTOR, OR PROPERTY, DIRECTLY OR INDIRECTLY ARISING OUT OF, OR

OCCASIONED BY THE PERFORMANCE OF CONTRACTOR UNDER THIS CONTRACT, INCLUDING CLAIMS AND DAMAGES ARISING IN WHOLE OR IN PART FROM THE NEGLIGENCE OF CITY, WITHOUT WAIVING THE CITY'S GOVERNMENTAL, SOVEREIGN OR OTHER IMMUNITIES OR DEFENSES AVAILABLE TO THE CITY UNDER TEXAS LAW AND WITHOUT WAIVING ANY DEFENSES OF THE PARTIES UNDER TEXAS LAW. IT IS THE EXPRESS INTENT OF THE PARTIES TO THIS CONTRACT THAT THE INDEMNITY PROVIDED FOR HEREIN IS AN INDEMNITY EXTENDED BY CONTRACTOR TO INDEMNIFY AND PROTECT CITY FROM THE CONSEQUENCES OF THE CONTRACTOR'S AS WELL AS THE CITY'S NEGLIGENCE, WHETHER SUCH NEGLIGENCE IS THE SOLE OR PARTIAL CAUSE OF ANY SUCH INJURY, DEATH, OR DAMAGE.

The provisions of this indemnification are solely for the benefit of the parties hereto and not intended to create or grant any rights, contractual or otherwise, to any other person or entity.

7.12.2 The Contractor will secure and maintain contractual liability insurance to cover this indemnification agreement that will be primary and non-contributory as to any insurance maintained by the City for its own benefit, including self-insurance. In addition, Contractor shall obtain and file with City a standard form Certificate of Insurance evidencing the required coverage.

7.12.3 In claims against any person or entity indemnified under this Paragraph 7.12 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under this Paragraph 7.12 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

7.13 NONDISCRIMINATION

7.13.1 The Contractor shall not discriminate in any way against any person, employee or job applicant on the basis of race, color, creed, national original, religion, age, sex, or disability where reasonable accommodations can be effected to enable the person to perform the essential functions of the job. The Contractor shall further insure that the foregoing nondiscrimination requirement shall be made a part and requirement of each subcontract on this Project.

7.14 PREVAILING WAGE RATES

7.14.1 The Contractor shall comply in all respects with all requirements imposed by any laws, ordinances or resolutions applicable to the Project with regard to the minimum prevailing wage rates for all classes of employees, laborers, subcontractors, mechanics, workmen and persons furnishing labor and services to the Project. The City has adopted a Prevailing Wage Rate Schedule, available to the Contractor by request (or attached to this contract as a part of the exhibits), which specifies the classes and wage rates to be paid to all persons. The Contractor shall pay not less than the minimum wage rates established thereby for each class, craft or type of labor, workman, or mechanic employed in the execution of this Contract. The failure of the Contractor to comply with this requirement shall result in the forfeiture to the City of a sum of not less than Sixty Dollars ($60.00) for each person per day, or portion thereof, that such person is paid less than the prevailing rate. Upon request by the City, Contractor shall make available for inspection and copying its books and records, including but not limited to its payroll records, account information and other documents as may be required by the City to insure compliance with this provision.

7.15 JOB SITE SAFETY PRECAUTIONS

7.15.1 The Contractor shall at all times exercise reasonable precautions for the safety of its employees, laborers, subcontractors, mechanics, workmen and others on and near the jobsite and shall comply with all laws, ordinances, regulations, and standards of federal, state and local safety laws and regulations. The Contractor shall provide such

machinery guards, safe walk-ways, ladders, bridges, and other safety devices as may be necessary or appropriate to insure a safe and secure jobsite and shall require its subcontractors to comply with this requirement. The Contractor shall immediately comply with any and all safety requirements imposed by the Engineer during the progress of the Work.

7.16 WARNING DEVICES AND BARRICADES

7.16.1 The Contractor shall furnish and maintain such warning devices, barricades, lights, signs, pavement markings, and other devices as may be necessary or appropriate or required by the Engineer to protect persons or property in, near or adjacent to the jobsite. No separate compensation shall be paid to the Contractor for such measures. Where the Work is being conducted in, upon or near streets, alleys, sidewalks, or other rights-of-way, the Contractor shall insure the placement, maintenance and operation of any and all such warning devices as may be required by the City and shall do so until no longer required by the City. Such devices shall be in compliance with and conform to the manual and specifications for the uniform system of traffic control devices adopted by the Texas Department of Transportation.

7.17 PROTECTION OF UTILITIES AND OTHER CONTRACTORS

7.17.1 The Contractor shall use best efforts to leave undisturbed and uninterrupted all utilities and utility services provided to the jobsite or which presently exists at, above or beneath the location where the Work is to be performed. In the event that any utility or utility service is disturbed or damaged during the progress of the Work, the Contractor shall forthwith repair, remedy or restore the utility at Contractor's sole expense. The Contractor shall coordinate any utility conflicts with the owner of the utility and no extension of time will be requested or given if adequate coordination is not provided by Contractor.

7.17.2 The Contractor understands and acknowledges that other contractors of the City or of other entities may be present at the jobsite performing other work unrelated to the Project. The Contractor shall use best efforts to work around other contractors without impeding the work of others while still adhering to the scheduled completion date. In the event that the Contractor's work is or may be delayed by any other person, the Contractor shall immediately give notice thereof to the Engineer and shall request a written Change Order in accordance with the procedures set forth by this Contract. The Contractor's failure to provide such notice and to request such Change Order shall constitute a waiver of any and all claims associated therewith.

ARTICLE VIII

CONTRACT ADMINISTRATION

8.1 THE ENGINEER

8.1.1 When used in this Contract the term "Engineer" does not necessarily denote a duly licensed, trained or certified engineer; as used herein, the term shall be used interchangeably and shall mean a designated Engineer, Engineer, or Contract Administrator (who may not be an architect or engineer) for the City, said person to be designated or re-designated by the City prior to or at any time during the Work hereunder. The Engineer may be an employee of the City or may be retained by the City as an independent contractor but, in either event, the Engineer's duties and authority shall be as set forth hereinafter. The Contractor understands and agrees that it shall abide by the decisions and instructions of the Engineer notwithstanding the contractual relationship between the City and Engineer, the title of Contract Administrator, or the fact that the Engineer is an employee of the City.

In the event the City should find it necessary or convenient to replace the Engineer, the City shall retain a replacement Engineer and the status of the replacement Engineer shall be that of the former Engineer.

8.2 ENGINEER'S ADMINISTRATION

8.2.1 The Engineer, unless otherwise directed by the City in writing, will perform those duties and discharge those responsibilities allocated to the Engineer as set forth in this Contract. The Engineer shall be the City's representative from the effective date of this Contract until final payment has been made.

8.2.2 The City and the Contractor shall communicate with each other in the first instance through the Engineer.

8.2.3 The Engineer shall be the initial interpreter of the requirements of the drawings and specifications and the judge of the performance thereunder by the Contractor. The Engineer shall render written or graphic interpretations necessary for the proper execution or progress of the Work with reasonable promptness on request of the Contractor.

8.2.4 The Engineer will review the Contractor's Applications for Payment and will certify to the City for payment to the Contractor, those amounts then due the Contractor as provided in this Contract.

8.2.5 The Engineer shall have authority to reject Work which is defective or does not conform to the requirements of this Contract. If the Engineer deems it necessary or advisable, the Engineer shall have authority to require additional inspection or testing of the Work for compliance with Contract requirements.

8.2.6 The Engineer will review and approve, or take other appropriate action as necessary, concerning the Contractor's submittals including Shop Drawings, Product Data and Samples. Such review, approval or other action shall be for the sole purpose of determining conformance with the design concept and information given through the Contract Documents.

8.2.7 The Engineer will prepare Change Orders and may authorize minor changes in the Work by Field Order as provided elsewhere herein.

8.2.8 The Engineer shall, upon written request from the Contractor, conduct inspections to determine the date of Substantial Completion and the date of final completion, will receive and forward to the City for the City's review and records, written warranties and related documents required by this Contract and will issue a final Certificate for Payment upon compliance with the requirements of this Contract.

8.2.9 The Engineer's decisions in matters relating to aesthetic effect shall be final if consistent with the intent of this Contract.

8.3 CLAIMS BY THE CONTRACTOR

8.3.1 The Engineer shall determine all claims and matters in dispute between the Contractor and City with regard to the execution, progress, or sufficiency of the Work or the interpretation of the Contract Documents, including but not limited to the plans and specifications. Any dispute shall be submitted in writing to the Engineer within seven (7) days of the event or occurrence or the first appearance of the condition giving rise to the claim or dispute and the Engineer shall render a written decision within a reasonable time thereafter. The Engineer’s decisions shall be final and binding on the parties. In the event that either party objects to the Engineer’s determination as to any submitted dispute, that party shall submit a written objection to the Engineer and the opposing party within ten (10) days of receipt of the Engineer’s written determination in order to preserve the objection. Failure to so object shall constitute a waiver of the objection for all purposes.

8.3.2 Pending final resolution of any claim of the Contractor, the Contractor shall diligently proceed with performance of this Contract and the City shall continue to make payments to the Contractor in accordance with this Contract.

8.3.3 CLAIMS FOR CONCEALED, LATENT OR UNKNOWN CONDITIONS - The Contractor expressly represents that it has been provided with an adequate opportunity to inspect the Project site and thoroughly review the Contract Documents and plans and specifications prior to submission of its bid and the City’s acceptance of the bid. Subject to the conditions hereof, Contractor assumes full responsibility and risk for any concealed, latent or unknown

condition which may affect the Work. No claims for extra work or additional compensation shall be made by Contractor in connection with concealed, latent or unknown conditions except as expressly provided herein. Should concealed, latent or unknown conditions encountered in the performance of the Work (a) below the surface of the ground or (b) in an existing structure be at variance with the conditions indicated by this Contract, or should unknown conditions of an unusual nature differing materially from those ordinarily encountered in the area and generally recognized as inherent in Work of the character provided for in this Contract, be encountered, the Contract Price shall be equitably adjusted by Change Order upon the written notice and claim by either party made within seven (7) days after the first observance of the condition. As a condition precedent to the City having any liability to the Contractor for concealed or unknown conditions, the Contractor must give the City and the Engineer written notice of, and an opportunity to observe, the condition prior to disturbing it. The failure by the Contractor to make the written notice and claim as provided in this Subparagraph shall constitute a waiver by the Contractor of any claim arising out of or relating to such concealed, latent or unknown condition and the Contractor thereby assumes all risks and additional costs associated therewith.

8.4 EXTRA WORK

8.4.1 The Contractor shall not claim, request or demand any sum from the City for Extra Work or for additional costs, and hereby waives all such claims, requests and demands and any right to assert same, unless the conditions of this subparagraph are strictly complied with. "Extra Work" is defined herein to mean any labor, service, materials, equipment, supplies or charges that are directly or indirectly related to the Work, the Project or the Project site, that is not necessarily or fairly required or implied by the Contract Documents.

8.4.2 The parties acknowledge and agree that there shall be no payment made by the City to the Contractor without a written agreement (either a separate contract or a written Change Order) signed by the parties. Should the Contractor perform Extra Work or be requested to perform Extra Work by the Engineer or City, it shall be the Contractor's obligation and duty to first apply for and obtain a written Change Order, approved by the Engineer and executed by the City. The Contractor's failure to obtain a written, signed Change Order prior to commencement of Extra Work shall constitute a complete and final waiver of any right for compensation for the Extra Work.

8.5 CLAIMS FOR ADDITIONAL COSTS OR TIME; CONTRACT PRICE INCREASE

8.5.1 If the Contractor wishes to make a claim for an increase in the Contract Price, as a condition precedent to any liability of the City therefor, the Contractor shall give the Engineer written notice of such claim within seven (7) days after the occurrence of the event, or the first appearance of the condition, giving rise to such claim. Such notice shall be given by the Contractor before proceeding to execute any additional or changed Work. The failure by the Contractor to give such notice and to give such notice prior to executing the Work shall constitute a waiver of any right to or claim for additional compensation.

8.5.2 In connection with any claim by the Contractor against the City for compensation in excess of the Contract Price, any liability of the City for the Contractor's costs shall be strictly limited to direct costs incurred by the Contractor and shall in no event include indirect costs or consequential damages of the Contractor. The City shall not be liable to the Contractor for claims of third parties, including Subcontractors. The City shall not be liable to the Contractor for any claims based upon delay to the Contractor for any reason whatsoever including any act or neglect on the part of the City.

8.5.3 If the Contractor is delayed in progressing any task which at the time of the delay is then critical or which during the delay becomes critical, as the sole result of any act or neglect to act by the City or someone acting in the City's behalf, or by changes ordered in the Work, unusual delay in transportation, unusually adverse weather conditions not reasonably anticipated, fire or any causes beyond the Contractor's control, then the date for achieving Substantial Completion of the Work shall be extended upon the written notice and claim of the Contractor to the City and the Engineer, for such reasonable time as the Engineer may determine. Any notice and claim for an extension of time by the Contractor shall be made not more than seven (7) days after the occurrence of the event or the first appearance of the condition giving rise to the claim and shall set forth in detail the Contractor's basis for requiring additional time in which to complete the Project. In the event the delay to the Contractor is a continuing one, only one notice and claim for additional time shall be necessary. If the Contractor fails to make such claim as required in this Subparagraph, any claim for an extension of time shall be waived. The procedures and remedies

provided by this provision shall be the sole remedy of Contractor and Contractor shall not assert nor be entitled to any additional delays or damages associated therewith.

8.6 FIELD ORDERS

8.6.1 The Engineer shall have authority to order minor changes in the Work not involving a change in the Contract Price or in Contract Time and not inconsistent with the intent of the Contract. Such changes shall be effected by Field Order and shall be binding upon the Contractor. The Contractor shall carry out such Field Orders promptly.

8.7 MEDIATION

8.7.1 In the event that a dispute arises under the terms of this Contract, following an adverse determination by the Engineer and proper preservation of the issue as required herein, the parties agree to submit to mediation. In such event, the parties shall agree to a designated person to serve as mediator and each party shall be responsible for payment of one-half of the total mediation fees. The parties shall submit the dispute to mediation as soon as practical and in no event later than one (1) year after the Engineer's written decision on the matter. At least one designated representative of each party must attend and participate in good faith in an effort to resolve the matters in dispute.

8.7.2 In no event shall the foregoing provision justify or authorize any delay in the progress of the Work; the parties shall abide by the decision of the Engineer in accomplishing the timely completion of the Project.

ARTICLE IX

SUBCONTRACTORS

9.1 DEFINITION

9.1.1 A Subcontractor is a person or entity that has a direct contract with the Contractor to perform a portion of the Work. No Subcontractor shall be in privity with the City.

9.2 AWARD OF SUBCONTRACTS

9.2.1 Upon execution of the Contract, the Contractor shall furnish the City, in writing, the names of persons or entities proposed by the Contractor to act as a Subcontractor on the Project. The City shall promptly reply to the Contractor, in writing, stating any objections the City may have to such proposed Subcontractor. The Contractor shall not enter into a subcontract with a proposed Subcontractor with reference to whom the City has made timely objection. The Contractor shall not be required to subcontract with any party to whom the Contractor has objection.

9.2.2 All subcontracts shall afford the Contractor rights against the Subcontractor which correspond to those rights afforded to the City against the Contractor herein, including those rights afforded to the City by Subparagraph 12.2.1 below. All subcontracts shall incorporate by reference the provisions hereof and shall provide that no claims, causes or demands shall be made by any Subcontractor against the City.

9.2.3 The Contractor shall indemnify, defend and hold harmless the City from and against any and all claims, demands, causes of action, damage, and liability asserted or made against the City by or on behalf of any Subcontractor.

ARTICLE X

CHANGES IN THE WORK

10.1 CHANGES PERMITTED

10.1.1 Changes in the Work within the general scope of this Contract, consisting of additions, deletions, revisions, or any combination thereof, may be ordered without invalidating this Contract, by Change Order or by Field Order.

10.1.2 Changes in the Work shall be performed under applicable provisions of this Contract and the Contractor shall proceed promptly with such changes.

10.2 CHANGE ORDER DEFINED

10.2.1 Change Order shall mean a written order to the Contractor executed by the City and the Engineer, issued after execution of this Contract, authorizing and directing a change in the Work or an adjustment in the Contract Price or the Contract Time, or any combination thereof. The Contract Price and the Contract Time may be changed only by written Change Order.

10.3 CHANGES IN THE CONTRACT PRICE

10.3.1 Any change in the Contract Price resulting from a Change Order shall be determined as follows: (a) by mutual agreement between the City and the Contractor as evidenced by (1) the change in the Contract Price being set forth in the Change Order, (2) such change in the Contract Price, together with any conditions or requirements related thereto, being initialed by both parties, and (3) the Contractor's execution of the Change Order, or (b) if no mutual agreement occurs between the City and the Contractor, then, as provided in Subparagraph 10.3.2 below.

10.3.2 If no mutual agreement occurs between the City and the Contractor as contemplated in Subparagraph 10.3.1 above, the change in the Contract Price, if any, shall then be determined by the Engineer on the basis of the reasonable expenditures or savings of those performing, deleting or revising the Work attributable to the change, including, in the case of an increase or decrease in the Contract Price, a reasonable allowance for direct job site overhead and profit. In such case, the Contractor shall present, in such form and with such content as the City or the Engineer require, an itemized accounting of such expenditures or savings, plus appropriate supporting data for inclusion in a Change Order. Reasonable expenditures or savings shall be limited to the following: reasonable costs of materials, supplies, or equipment including delivery costs, reasonable costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance, reasonable rental costs of machinery and equipment exclusive of hand tools whether rented from the Contractor or others, reasonable costs of premiums for all bonds and insurance, permit fees, and sales, use or other taxes related to the Work, and reasonable cost of direct supervision and jobsite field office overhead directly attributable to the change. In no event shall any expenditure or savings associated with the Contractor's home office or other non-jobsite overhead expense be included in any change in the Contract Price. Pending final determination of reasonable expenditures or savings to the City, payments on account shall be made to the Contractor on the Engineer's Certificate for Payment.

10.3.3 If unit prices are provided in the Contract, and if the quantities contemplated are so changed in a proposed Change Order that application of such unit prices to the quantities of Work proposed will cause substantial inequity to the City or to the Contractor, the applicable unit prices shall be equitably adjusted.

10.4 MINOR CHANGES

10.4.1 The Engineer shall have authority to order minor changes in the Work not involving a change in the Contract Price or an extension of the Contract Time and not inconsistent with the intent of this Contract. Such minor changes shall be made by written Field Order, and shall be binding upon the City and the Contractor. The Contractor shall promptly carry out such written Field Orders.

10.5 EFFECT OF EXECUTED CHANGE ORDER

10.5.1 The execution of a Change Order by the Contractor shall constitute conclusive evidence of the Contractor's agreement to the ordered changes in the Work, this Contract as thus amended, the Contract Price and the Contract Time. The Contractor, by executing the Change Order, waives and forever releases any claim against the City for additional time or compensation for matters relating to or arising out of or resulting from the Work included within or affected by the executed Change Order.

10.6 NOTICE TO SURETY; CONSENT

10.6.1 The Contractor shall notify and obtain the consent and approval of the Contractor's surety with reference to all Change Orders if such notice, consent or approval are required by the Contractor's surety or by law. The Contractor's execution of the Change Order shall constitute the Contractor's warranty to the City that the surety has been notified of and consents to, such Change Order and the surety shall be conclusively deemed to have been notified of such Change Order and to have expressly consented thereto.

ARTICLE XI

UNCOVERING AND CORRECTING WORK

11.1 UNCOVERING WORK

11.1.1 If any of the Work is covered contrary to the Engineer's request or to any provisions of this Contract, it shall, if required by the Engineer or the City, be uncovered for the Engineer's inspection and shall be properly replaced at the Contractor's expense without change in the Contract Time or Contract Price.

11.1.2 If any of the Work is covered in a manner consistent with the Engineer’s request or the provisions of this Contract, it shall, if required by the Engineer or City, be uncovered for the Engineer's inspection. If such Work conforms strictly to this Contract, costs of uncovering and proper replacement shall by Change Order be charged to the City. If such Work does not strictly conform to this Contract, the Contractor shall pay the costs of uncovering and proper replacement.

11.2 CORRECTING WORK

11.2.1 The Contractor shall immediately proceed to correct Work rejected by the Engineer as defective or failing to conform to this Contract. The Contractor shall pay all costs and expenses associated with correcting such rejected Work, including any additional testing and inspections, and reimbursement to the City for the Engineer's services and expenses made necessary thereby.

11.2.2 If within four (4) years after Substantial Completion of the Work any of the Work is found to be defective or not in accordance with this Contract, the Contractor shall correct it promptly upon receipt of written notice from the City. This obligation shall survive final payment by the City and termination of this Contract. With respect to Work first performed and completed after Substantial Completion, this four year obligation to specifically correct defective and nonconforming Work shall be extended by the period of time which elapses between Substantial Completion and completion of the subject Work.

11.2.3 Nothing contained in this Paragraph 11.2 shall establish any period of limitation with respect to other obligations which the Contractor has under this Contract. Establishment of the four year time period in Subparagraph 11.2.2 relates only to the duty of the Contractor to specifically correct the Work.

11.3 CITY MAY ACCEPT DEFECTIVE OR NONCONFORMING WORK

11.3.1 If the City chooses to accept defective or nonconforming Work, the City may do so at its sole discretion. In such event, the Contract Price shall be reduced by the greater of (a) the reasonable cost of removing and correcting the defective or nonconforming Work, and (b) the difference between the fair market value of the Project as constructed and the fair market value of the Project had it not been constructed in such a manner as to include defective or nonconforming Work. If the remaining portion of the unpaid Contract Price, if any, is insufficient to compensate the City for its acceptance of defective or nonconforming Work, the Contractor shall, upon written demand from the City, pay the City such remaining compensation for accepting defective or nonconforming Work.

ARTICLE XII

CONTRACT DEFAULT AND TERMINATION

12.1 TERMINATION BY THE CONTRACTOR

12.1.1 If the Work is stopped for a period of ninety (90) days by an order of any court or other public authority, or as a result of an act of the Government, through no fault of the Contractor or any person or entity working directly or indirectly for the Contractor, the Contractor may, upon fifteen (15) days' written notice to the City and the Engineer, terminate performance under this Contract and recover from the City payment for the actual reasonable expenditures of the Contractor (as limited in Subparagraph 10.3.2 above) for all Work executed and for materials, equipment, tools, construction equipment and machinery actually purchased or rented solely for the Work, less any salvage value of any such items.

12.1.2 If the City shall persistently or repeatedly fail to perform any material obligation to the Contractor for a period of fifteen (15) days after receiving written notice from the Contractor of its intent to terminate hereunder, the City shall have fifteen (15) days to remedy its failure and if not so cured, the Contractor may terminate performance under this Contract by written notice to the Engineer and the City. In such event, the Contractor shall be entitled to recover from the City as though the City had terminated the Contractor's performance under this Contract for convenience pursuant to Subparagraph 12.2.1 hereunder.

12.2 TERMINATION BY THE CITY

12.2.1 FOR CONVENIENCE

12.2.1.1 The City may for any reason whatsoever terminate performance under this Contract by the Contractor for convenience. The City shall give written notice of such termination to the Contractor specifying when termination becomes effective.

12.2.1.2 The Contractor shall incur no further obligations in connection with the Work and the Contractor shall stop Work when such termination becomes effective. The Contractor shall also terminate outstanding orders and subcontracts. The Contractor shall settle the liabilities and claims arising out of the termination of subcontracts and orders. The City may direct the Contractor to assign the Contractor's right, title and interest under terminated orders or subcontracts to the City or its designee.

12.2.1.3 The Contractor shall transfer title and deliver to the City such completed or partially completed Work and materials, equipment, parts, fixtures, information and Contract rights as the Contractor has.

12.2.1.4 (a) The Contractor shall submit a termination claim to the City and the Engineer specifying the amounts due because of the termination for convenience together with costs, pricing or other data required by the Engineer. If the Contractor fails to file a termination claim within one (1) year from the effective

date of termination, the City shall pay the Contractor, an amount derived in accordance with subparagraph (c) below.

(b) The City and the Contractor may agree to the compensation, if any, due to the Contractor hereunder.

(c) Absent agreement to the amount due to the Contractor, the City shall pay the Contractor the following amounts:

(i) Contract prices for labor, materials, equipment and other services accepted under this Contract;

(ii) Reasonable costs incurred in preparing to perform and in performing the terminated portion of the Work, and in terminating the Contractor's performance, plus a fair and reasonable allowance for overhead and profit thereon (such profit shall not include anticipated profit or consequential damages), provided however, that if it appears that the Contractor would have not profited or would have sustained a loss if the entire Contract would have been completed, no profit shall be allowed or included and the amount of compensation shall be reduced to reflect the anticipated rate of loss, if any;

(iii) Reasonable costs of settling and paying claims arising out of the termination of subcontracts or orders pursuant to Subparagraph 12.2.1.2 of this Paragraph. These costs shall not include amounts paid in accordance with other provisions hereof.

12.2.1.5 The total sum to be paid the Contractor under this Subparagraph 12.2.1 shall not exceed the total Contract Price, as properly by amounts withheld by the City and reduced by the amount of payments otherwise made, and shall in no event include duplication of payment.

12.2.2 FOR CAUSE

12.2.2.1 The following constitute grounds for termination of this Contract by the City:

(a) the Contractor’s failure or refusal to prosecute the Work in a timely manner;

(b) The Contractor abandons the jobsite and fails to resume work within five (5) days of written notice thereof by the City;

(c) the Contractor fails to meet milestones or comply with approved construction schedules;

(d) the Contractor fails to grant or allow access to the jobsite by the City or Engineer;

(e) the Contractor fails to supply enough properly skilled workers, supervisory personnel or proper equipment or materials;

(f) the Contractor fails to make prompt payment to Subcontractors or for materials or labor;

(g) the Contractor persistently disregards laws, ordinances, rules, regulations or orders of any public authority having jurisdiction; or,

(h) the Contractor is otherwise guilty of a violation of a material provision of this Contract.

In the event of the occurrence of any one or more of the above events, the City may by written notice to the Contractor, without prejudice to any other right or remedy, terminate the employment of the Contractor, exclude the Contractor from the job site, and take possession of the site and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor and may finish the Work by whatever methods it may deem expedient. In such case, the Contractor shall not be entitled to receive any further payment until the Work is finished.

12.2.2.2 If the unpaid balance of the Contract Price does not exceed the cost of finishing the work, including compensation for the Engineer's additional services and expenses made necessary thereby, such difference shall be paid by the Contractor to the City. This obligation for payment shall survive the termination of the Contract.

12.2.2.3 In the event the employment of the Contractor is terminated by the City for cause pursuant to Subparagraph 12.2.2 and it is subsequently determined by a Court of competent jurisdiction that such termination was without cause, such termination shall thereupon be deemed a Termination for Convenience under Subparagraph 12.2.1 and the provisions of Subparagraph 12.2.1 shall apply.

12.3 USE OF THIRD-PARTY OVERSIGHT OR CONSTRUCTION MANAGER

12.3.1 Should the City allow the Contractor to continue its performance of Work notwithstanding an event of default specified in Subparagraph 12.2.2.1, or should there be an imminent potential of default, the City, at its sole option and within its sole discretion, may retain a third-party construction manager to document the events of default and oversee further progress of the Work. The use of a third-party construction manager shall not prevent the City from declaring the Contractor to be in default and the City may, at its sole option and within its sole discretion, terminate this Contract at any time. Should the City retain a third-party construction manager, the costs thereof shall be withheld from any amounts due Contractor upon termination. The City's exercise of this option shall be without prejudice to any other right or remedy available to the City by law or under this Contract.

ARTICLE XIII

INSURANCE

13.1 CONTRACTOR SHALL MAINTAIN INSURANCE

13.1.1 The Contractor at its own expense shall purchase, maintain and keep in force during the life of this contract, adequate insurance that will protect the Contractor and/or any Additional Insured from claims which may arise out of or result from operations under this Contract. The insurance required shall provide adequate protections from all claims, whether such operations be by the Contractor or by any Additional Insured or by any Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone whose acts of any of them may be liable and from any special hazards, such as blasting, which may be encountered in the performance of this contract in the amounts as shown below in Paragraph 13.2.1.

13.1.2 The Contractor shall not commence work on any Contract in the City until the Contractor has obtained all the insurance required under this paragraph and such insurance has been approved by the City.

13.2 TYPES AND AMOUNTS OF CONTRACTOR'S INSURANCE

13.2.1. The Contractor shall furnish and maintain during the life of the contract adequate Worker's Compensation and Commercial General Liability (Public) Insurance in such amounts as follows:

Type of Insurance	**Amount**
Worker's Compensation	As set forth in the Worker's Compensation Act.
Commercial General Liability (Public)	$1,000,000 Each Accident/Occurrence. $1,000,000 Aggregate $1,000,000 Products & Completed Operations Aggregate.
City's Protective	$600,000 per occurrence

Liability Insurance	$1,000,000 aggregate
Excess/Umbrella Liability	$1,000,000 per occurrence w/drop down coverage
Endorsement CG 2503	Amendment Aggregate Limit of Insurance per Project or City's and Contractor's Protective Liability Insurance for the Project.
Automobile Liability	$500,000 Combined single limit per occurrence.

13.3 ADDITIONAL INSURED

13.3.1 The City and the Engineer shall be named as an additional insured on the Commercial General Liability (Public), City's Protective Liability, and Excess/Umbrella Liability Insurance Policies furnished by the Contractor.

13.4 WRITTEN NOTIFICATION

13.4.1 Each insurance policy shall contain a provision requiring that thirty (30) days prior to expiration, cancellation, non-renewal or any material change in coverage, a notice there of shall be given by certified mail to the City of Lucas, Attention: Joni Clarke, City Manager, 665 Country Club Road, Lucas, TX 75002-7561.

13.5 PREMIUMS AND ASSESSMENTS; SUBROGATION

13.5.1 Companies issuing the insurance policies shall have no recourse against the City for payment of any premiums or assessments for any deductibles which are at the sole responsibility and risk of the Contractor. Insurance Companies shall have no right of subrogation against the City or the Engineer.

13.6 CERTIFICATE OF INSURANCE

13.6.1 Proof that the insurance is in force shall be furnished to the City on Standard Certificate of Insurance Forms. In the event any insurance policy shown on the Certificate of Insurance has an expiration date that is prior to the completion and final acceptance of the project by the City, the contractor shall furnish the City proof of identical continued coverage no later than thirty(30) days prior to the expiration date shown on the Certificate of Insurance.

13.7 PRIMARY COVERAGE

13.7.1 The coverages provided herein shall be primary and noncontributory with any other insurance maintained by the City, for its benefit, including self-insurance.

13.8 WORKER'S COMPENSATION INSURANCE COVERAGE

13.8.1 The Contractor shall:

(1) provide coverage for its employees providing services on a project, for the duration of the project based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements;

(2) provide a certificate of coverage showing workers' compensation coverage to the governmental entity prior to beginning work on the project;

(3) provide the governmental entity prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the contractor's current certificate of coverage ends during the duration of the project;

(4) obtain from each person providing services on a project, and provide to the governmental entity:

(A) a certificate of coverage, prior to that person beginning work on the project, so the governmental entity will have on file certificates of coverage showing coverage for all persons providing services on the project; and

(B) no later than seven days after receipt by the contractor, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the Project;

(5) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(6) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the contractor knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project;

(7) post a notice on each project site informing all persons providing services on the project that they are required to be covered, and stating how a person may verify current coverage and report failure to provide coverage. This notice shall comply with the requirements established by the Division of Workers Compensation of the Texas Department of Insurance, or its successor agency.

and

(8) contractually require each person with whom it contracts to provide services on a project, to:

(A) provide coverage based on proper reporting of classification codes and payroll amounts and filing of any coverage agreements for all of its employees providing services on the project, for the duration of the project;

(B) provide a certificate of coverage to the contractor prior to that person beginning work on the project;

(C) provide the Contractor, prior to the end of the coverage period, a new certificate of coverage showing extension of coverage, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(D) obtain from each other person with whom it contracts, and provide to the Contractor:

(i) a certificate of coverage, prior to the other person beginning work on the project; and

(ii) prior to the end of the coverage period, a new certificate of coverage showing extension of the coverage period, if the coverage period shown on the current certificate of coverage ends during the duration of the project;

(E) retain all required certificates of coverage on file for the duration of the project and for one year thereafter;

(F) notify the governmental entity in writing by certified mail or personal delivery, within 10 days after the person knew or should have known, of any change that materially affects the provision of coverage of any person providing services on the project; and

(G) contractually require each other person with whom it contracts, to perform as required by sub-paragraphs (A) - (G) of this paragraph, with the certificate of coverage to be provided to the person for whom they are providing services.

ARTICLE XIV

MISCELLANEOUS

14.1 LAWS AND ORDINANCES

14.1.1 The Contractor shall at all times and in all respects observe and comply with all federal, state and local laws, ordinances, and regulations applicable to the Project and Work. The Contractor shall further insure that all Subcontractors observe and comply with said laws, ordinances and regulations.

14.2 GOVERNING LAW

14.2.1 The Contract shall be governed by the laws of the State of Texas. Exclusive venue for any causes of action arising under the terms or provisions of this Contract or the Work to be performed hereunder shall be in the state courts of Collin County, Texas.

14.3 SUCCESSORS AND ASSIGNS

14.3.1 The City and Contractor bind themselves, their successors, assigns and legal representatives to the other party hereto and to successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in this Contract. The Contractor shall not assign this Contract without written consent of the City.

14.4 SURETY BONDS

14.4.1 The Contractor shall furnish separate performance and payment bonds to the City, according to the requirements set out in the bid documents and state statutes to guaranty full and faithful performance of the Contract by the Contractor and the full and final payment of all persons supplying labor or materials to the Project. Each bond required by the bid documents or state statute shall set forth a penal sum in an amount not less than the full Contract Price. Each bond furnished by the Contractor shall incorporate by reference the terms of this Contract as fully as though they were set forth verbatim in such bonds. In the event the Contract Price is adjusted by Change Order executed by the Contractor, the penal sum of both the performance bond and the payment bond shall be deemed increased by like amount. The performance and payment bonds furnished by the Contractor shall be in form suitable to the City and shall be executed by a surety, or sureties, reasonably suitable to the City and authorized to do business in the State of Texas.

14.4.2 If the Contract Price exceeds the sum of $25,000.00, the Contractor, upon execution of the Contract and prior to commencement of the Work, shall furnish to the City a two-year maintenance bond in the amount of one hundred percent (100%) of the Contract Price covering the guaranty and maintenance prescribed herein, written by an approved surety authorized and duly licensed to conduct business in the State of Texas. The cost of said maintenance bond shall be included in the Contractor's unit bid prices and shall be paid by the Contractor.

14.5 FORCE MAJEURE

14.5.1 As used herein, "force majeure" means an incident, situation, or act of a third party that is beyond a party's reasonable control such as an act of God, an act of the public enemy, strikes or other labor disturbances (other than strikes within such party's own labor force), hurricanes, earthquakes, fires, floods, epidemics, embargoes, war, and riots. The Contractor will not be liable or responsible for its failure to perform any obligation under this Contract because of an event of Force Majeure, provided, however, that the Contractor submits notice thereof to the City and

Engineer within seven (7) days of such an event, obtains a written Change Order, signed by all parties, that allows an extension of the scheduled completion date, and identifies the specific causes and number of days in the Statement of Delay submitted with the next ensuing Application for Payment. Notwithstanding, if the Contractor's failure to perform continues for more than twenty (20) calendar days, the City may at its option terminate this Agreement immediately and pursue such rights and remedies as may be allowed under Subparagraph 12.2.2 of this Contract.

14.6 IMMUNITIES; DEFENSES

14.6.1 Nothing in this Contract shall be deemed to waive any immunity, sovereign, governmental, official, qualified or otherwise, from liability or suit, which the City may have or assert, except as may be provided by law, all such immunities being hereby expressly retained.

14.7 NO RIGHTS IN THIRD PARTIES

14.7.1 The indemnification provisions of this Contract and the rights and remedies afforded herein are solely for the benefit of the parties to this Contract. Nothing in this Contract is intended nor shall be construed to grant, create or confer any right, benefit, interest or cause of action in any person not a party to this Contract, or to the public in general.

14.8 SEVERABILITY

14.8.1 The provisions of this Contract are herein declared to be severable; in the event that any term, provision or part hereof is determined to be invalid, void or unenforceable, such determination shall not affect the validity or enforceability of the remaining terms, provisions and parts, and this Contract shall be read as if the invalid, void or unenforceable portion had not been included herein.

14.9 AMENDMENTS; NO WAIVER

14.9.1 This Contract may be amended by the parties only by a written agreement duly executed by both parties. The failure of the City to object to any nonperformance or nonconforming work or to enforce any provision hereof shall in no event be regarded as or construed to be a waiver, release or modification of any term or provision in this Contract, nor shall such failure to object or enforce estop the City from insisting on strict compliance with this Contract or from recovering damages, costs or expenses arising as a result of such nonperformance or nonconforming work.

14.10 NOTICES

14.10.1 All notices required by this Contract shall be in writing and presumed received when deposited in the mail properly addressed to the other party or Engineer at the address set forth herein or set forth in a written designation of change of address delivered to all parties and the Engineer.

EXECUTED in single or multiple originals, this _____ day of _____, 2014.

CITY OF LUCAS, TEXAS	**CONTRACTOR**:
	_____
_____	_____
Rebecca Mark, Mayor	(Signature)

_____
(Type/Print Name and Title)

ATTEST:

_____
(Street Address)

_____ _____
City Secretary (Rev. 03/14) (City/State/Zip)

APPROVED TO FORM

_____
City Attorney

DOCUMENT 00 6113
PERFORMANCE BOND

STATE OF TEXAS)
)
COUNTY OF COLLIN)

KNOW ALL MEN BY THESE PRESENTS: That _____ whose address is _____, hereinafter called Principal, and _____, a corporation organized and existing under the laws of the State of _____, and fully licensed to transact business in the State of Texas, as Surety, are held and firmly bound unto the City of Lucas, organized and existing under the laws of the State of Texas, hereinafter called "Beneficiary", in the penal sum of _____ Dollars ($_____) plus fifteen percent (15%) of the stated penal sum as an additional sum of money representing additional court expenses, attorneys' fees, and liquidated damages arising out of or connected with the below identified Contract in lawful money of the United States, to be paid in Collin County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents. The penal sum of this Bond shall automatically be increased by the amount of any Change Order or Supplemental Agreement, which increases the Contract price, but in no event shall a Change Order or Supplemental Agreement, which reduces the Contract price, decrease the penal sum of this Bond.

THE OBLIGATION TO PAY SAME is conditioned as follows: Whereas, the Principal entered into a certain Contract with the City of Lucas, the Beneficiary, dated on or about the _____ day of _____, A.D. 20____, a copy of which is attached hereto and made a part hereof, to furnish all materials, equipment, labor, supervision, and other accessories necessary for the construction of:

Central Fire Station Addition

as more particularly described and designated in the above-referenced contract such contract being incorporated herein and made a part hereof as fully and to the same extent as if written herein word for word.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform and fulfill all of the undertakings, covenants, terms, conditions and agreements of said Contract in accordance with the Plans, Specifications and Contract Documents during the original term thereof and any extension thereof which may be granted by the Beneficiary, with or without notice to the Surety, and during the life of any guaranty or warranty required under this Contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; and, if the Principal shall repair and/or replace all defects due to faulty materials and workmanship that appear within a period of two (2) years from the date of final completion and final acceptance of the Work by Owner; and, if the Principal shall fully indemnify and save harmless the Beneficiary from and against all costs and damages which Beneficiary may suffer by reason of failure to so perform herein and shall fully reimburse and repay Beneficiary all outlay and expense which the Beneficiary may incur in making good any default or deficiency, then this obligation shall be void; otherwise, it shall remain in full force and effect.

PROVIDED FURTHER, that if any legal action were filed on this Bond, exclusive venue shall lie in Collin County, Texas.

AND PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder or the Plans, Specifications and Drawings, etc., accompanying the same

shall in anywise 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, or to the Work or to the Specifications.

This Bond is given pursuant to the provisions of Chapter 2253 of the Texas Government Code, and any other applicable statutes of the State of Texas.

The undersigned and designated agent is hereby designated by the Surety herein as the Resident Agent in Collin County or Dallas County to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of such suretyship, as provided by Article 7.19-1 of the Insurance Code, Vernon's Annotated Civil Statutes of the State of Texas.

IN WITNESS WHEREOF, this instrument is executed in six copies, each one of which shall be deemed an original, this, the _____ day of _____, 20____.

PRINCIPAL: _____

BY: _____
Name

ATTEST:

_____ TITLE: _____

SURETY: _____

BY: _____
Name

ATTEST:

_____ TITLE: _____

The Resident Agent of the Surety in Collin County or Dallas County, Texas, for delivery of notice and service of the process is:

NAME: _____
STREET ADDRESS: _____
CITY, STATE, ZIP: _____

NOTE: Date on **Page 1** of Performance Bond must be **same date as Contract**. Date on **Page 2** of Performance Bond must be **after date of Contract**. If Resident Agent is not a corporation, give a person's name.

END OF DOCUMENT

DOCUMENT 00 6116
PAYMENT BOND

STATE OF TEXAS)
)
COUNTY OF COLLIN)

KNOW ALL MEN BY THESE PRESENTS: That _____ whose address is _____, hereinafter called Principal, and_____, a corporation organized and existing under the laws of the State of _____, and fully licensed to transact business in the State of Texas, as Surety, are held and firmly bound unto the **City of Lucas,** organized and existing under the laws of the State of Texas, hereinafter called "Owner", and unto all persons, firms, and corporations who may furnish materials for, or perform labor upon the building or improvements hereinafter referred to in the penal sum of _____ DOLLARS ($_____) in lawful money of the United States, to be paid in Collin County, Texas, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents. The penal sum of this Bond shall automatically be increased by the amount of any Change Order or Supplemental Agreement, which increases the Contract price, but in no event shall a Change Order or Supplemental Agreement, which reduces the Contract price, decrease the penal sum of this Bond.

THE OBLIGATION TO PAY SAME is conditioned as follows: Whereas, the Principal entered into a certain Contract with the City of Lucas, the Owner, dated on or about the _____ day of _____, A.D. 20___, a copy of which is attached hereto and made a part hereof, to furnish all materials, equipment, labor, supervision, and other accessories necessary for the construction of:

Central Fire Station Addition

NOW THEREFORE, if the Principal shall well, truly and faithfully perform its duties and make prompt payment to all persons, firms, subcontractors, corporations and claimants supplying labor and/or material in the prosecution of the Work provided for in the above-referenced Contract and any and all duly authorized modifications of said Contract that may hereafter be made, notice of which modification to the Surety is hereby expressly waived, then this obligation shall be void; otherwise it shall remain in full force and effect.

PROVIDED FURTHER, that if any legal action were filed on this Bond, exclusive venue shall lie in Collin County, Texas.

AND PROVIDED FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the Work performed thereunder, or the Plans, Specifications, Drawings, etc., accompanying the same, shall in anywise 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, or to the Work to be performed thereunder.

This Bond is given pursuant to the provisions of Chapter 2253 of the Texas Government Code, and any other applicable statutes of the State of Texas.

The undersigned and designated agent is hereby designated by the Surety herein as the Resident Agent in Collin County or Dallas County to whom any requisite notices may be delivered and on whom service of process may be had in matters arising out of such suretyship, as provided by Article 7.19-1 of the Insurance Code, Vernon's Annotated Civil Statutes of the State of Texas.

IN WITNESS WHEREOF, this instrument is executed in six copies, each one of which shall be deemed an original, this, the _____ day of _____, 20___.

PRINCIPAL: _____

BY: _____
Name

ATTEST:

_____ TITLE: _____

SURETY: _____

BY: _____
Name

ATTEST:

_____ TITLE: _____

The Resident Agent of the Surety in Collin County or Dallas County, Texas, for delivery of notice and service of the process is:

NAME: _____
STREET ADDRESS: _____
CITY, STATE, ZIP: _____

NOTE: Date on **Page 1** of Performance Bond must be **same date as Contract**. Date on **Page 2** of Performance Bond must be **after date of Contract**. If Resident Agent is not a corporation, give a person's name.

END OF DOCUMENT

DOCUMENT 00 6119
MAINTENANCE BOND

STATE OF TEXAS)
)
COUNTY OF COLLIN)

KNOW ALL BY THESE PRESENTS: That _____ whose address is_____, hereinafter referred to as "Principal," and _____, a corporate surety/sureties organized under the laws of the State of _____ and fully licensed to transact business in the State of Texas, as Surety, hereinafter referred to as "Surety" (whether one or more), are held and firmly bound unto the **City of Lucas**, hereinafter referred to as "Owner," in the penal sum of _____ DOLLARS ($_____) (fifteen percent (15%) of the total bid price), in lawful money of the United States to be paid to Owner, its successors and assigns, for the payment of which sum well and truly to be made, we bind ourselves, our successors, heirs, executors, administrators and successors and assigns, jointly and severally; and firmly by these presents, the condition of this obligation is such that:

WHEREAS, Principal entered into a certain written Contract with the City of Lucas, dated on or about the _____ day of _____, 20____, to furnish all permits, licenses, bonds, insurance, products, materials, equipment, labor, supervision, and other accessories necessary for the construction of:

Central Fire Station Addition

as more particularly described and designated in the above-referenced contract, such contract being incorporated herein and made a part hereof as fully and to the same extent as if written herein word for word:

WHEREAS, in said Contract, the Principal binds itself to use first class materials and workmanship and of such kind and quality that for a period of two (2) years from the completion and final acceptance of the improvements by Owner the said improvements shall require no repairs, the necessity for which shall be occasioned by defects in workmanship or materials and during the period of two (2) years following the date of final acceptance of the Work by Owner, Principal binds itself to repair or reconstruct said improvements in whole or in part at any time within said period of time from the date of such notice as the Owner shall determine to be necessary for the preservation of the public health, safety or welfare. If Principal does not repair or reconstruct the improvements within the time period designated, Owner shall be entitled to have said repairs made and charge Principal and/or Surety the cost of same under the terms of this Maintenance Bond.

NOW, THEREFORE, if Principal will maintain and keep in good repair the Work herein contracted to be done and performed for a period of two (2) years from the date of final acceptance and do and perform all necessary work and repair any defective condition (it being understood that the purpose of this section is to cover all defective conditions arising by reason of defective materials, work or labor performed by Principal) then this obligation shall be void; otherwise it shall remain in full force and effect and Owner shall have and recover from Principal and its Surety damages in the premises as provided in the Plans and Specifications and Contract.

PROVIDED, however, that Principal hereby holds harmless and indemnifies Owner from and against any claim or liability for personal injury or property damage caused by and occurring during the performance of said maintenance and repair operation.

PROVIDED, further, that if any legal action be filed on this Bond, exclusive venue shall lie in Collin County, Texas.

AND PROVIDED FURTHER, Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work performed thereunder, or the Plans, Specifications, Drawings, etc. accompanying same 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 or to the Work to be performed thereunder.

The undersigned and designated agent is hereby designated by Surety as the resident agent in either Collin or Dallas Counties to whom all requisite notice may be delivered and on whom service of process may be had in matters arising out of this suretyship.

IN WITNESS WHEREOF, this instrument is executed in six copies, each one of which shall be deemed an original, on this the _____ day of _____, 20____.

ATTEST:

PRINCIPAL:

_____
Company Name

By: _____
Signature

_____
Typed/Printed Name

_____
Title

_____
Address

_____
City State Zip

_____
Phone Fax

By: _____
Signature

_____
Typed/Printed Name

_____
Title

_____
Address

_____
City State Zip

_____
Phone Fax

ATTEST:

SURETY:

By: _____
Signature

_____
Printed Name

_____
Title

_____
Address

_____
City State Zip

_____
Phone Fax

By: _____
Signature

_____
Printed Name

_____
Title

_____
Address

_____
City State Zip

_____
Phone Fax

END OF DOCUMENT

DOCUMENT 00 7200
GENERAL CONDITIONS

A. General Conditions of this Contract is the City of Lucas standard contract for construction services, hereinafter referred to as the General Conditions.

B. General Conditions shall apply to each and every Section of the Work as though written in full therein and are made a part of the Contract Documents by reference.

END OF DOCUMENT

THIS PAGE INTENTIONALLY BLANK

SECTION 01 1000
SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Work covered by Contract Documents.
2. Work by Owner.
3. Access to site.
4. Coordination with occupants.
5. Specification and drawing conventions.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
1. A 9,700 square foot addition to the existing Fire Station 2 in Lucas, Texas.

B. Type of Contract: Project will be constructed under a single prime contract.

1.3 WORK BY OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.

B. Concurrent Work: Owner will perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract.
1. Construction Material Testing
2. Commissioning / Air Balance Test
3. FFE (Fixtures, Furn., Equipment)
4. Washer/Dryer
5. Refrigerators
6. Data/IT/Radio/Technology
7. Landscaping/ Irrigation
8. Water Utility piping - All
9. Landscape and Domestic meter
10. Flag Poles
11. Fire Protection System - New & Existing
12. Fire Hydrant
13. Fire Alarm System - New & Existing
14. Apparatus Approach - Drainage Piping and Asphalt (existing only)
15. Emergency Generator and Transfer Switch
16. Screen wall & gates around Generator
17. Advertisement for Bidding
18. Final Plat

1.4 ACCESS TO SITE

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

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Limit use of Project site to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

D. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.

1.5 COORDINATION WITH OCCUPANTS

A. Full Owner Occupancy: The fire station, and the adjacent building to the south, will continue to operate as a fully functional fire station. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and approval of authorities having jurisdiction.
2. Notify Owner not less than 72 hours in advance of activities that will affect Owner's operations.

1.6 SPECIFICATION AND DRAWING CONVENTIONS

A. 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:
   1. Imperative mood and streamlined language are generally used in the Specifications. 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.
   2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 2200
UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for unit prices.

1.2 DEFINITIONS

A. Unit price is an amount proposed by bidders, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, and profit.

B. Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A list of unit prices is included at the end of this Section. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 UNIT PRICE SCHEDULE

A. As indicated in Document 00 4100 - Proposal Form.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 2300
ALTERNATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for alternates.

1.2 DEFINITIONS

A. Alternate: An amount proposed by proposers and stated on the Proposal Form for certain work defined in the Proposal Requirements that may be added to or deducted from the base proposal 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. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. 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.

1.3 PROCEDURES

A. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project. 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. DEDUCT ALTERNATE NO. 1: Delete paved parking area as indicated on Civil Drawings.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 2600
CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for handling and processing Contract modifications.

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. Within time specified in Proposal Request and 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 to Architect using Contractor’s Standard Form.

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.

1.4 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order 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.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order 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 Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive instructing 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

SECTION 01 2900
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements necessary to prepare and process following on Project including, but not limited to, the following:
   1. Schedule of Values.
   2. Applications for Payment.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule specified by Section 01 3200 - Construction Progress Documentation.
   1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including Submittals Schedule and Application for Payment forms with Continuation Sheets.
   2. Submit the Schedule of Values to Architect at earliest possible date but no later than 7 days before the date scheduled for submittal of initial Applications for Payment.
   3. Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.

B. 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 Owner.
      c. Owner’s project number and purchase order number.
      d. Name of Architect.
      e. Architect's project number.
      f. Contractor's name and address.
      g. Date of submittal.
   2. Format: 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; 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. Coordinate with the Project Manual table of contents. 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. Provide additional line items as requested by Architect to facilitate review.
   6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
   7. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.

8. 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. 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. Payment Application Times: The date for each progress payment is the last day of each month. The time period covered by each Application for Payment is from the beginning to the end of each calendar month.

B. Payment Application Forms: Use following forms for Applications for Payment:
1. American Institute of Architects Document G702™, "Application and Certificate for Payment," 1992 (copy follows this Section).
2. American Institute of Architects Document G703 ™, "Continuation Sheet," 1992 (copy follows this Section).

C. Requests for Additional Time: In addition to requirements of this Section, attach copies of requests for additional time due to weather delays to each Progress Payment. Requests for additional days will only be considered if submitted to Architect within 7 days after the beginning of the delay and copies of each request are attached to each Progress Payment. Approved additional days will be processed by change order.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.

E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt. All copies shall include waivers of lien and an updated construction time schedule. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.
1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:
   a. Materials previously stored and included in previous Applications for Payment.
   b. Work completed for this Application utilizing previously stored materials.
   c. Additional materials stored with this Application.
   d. Total materials remaining stored, including materials with this Application.

G. 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.
1. Submit partial waivers on each item for amount requested in previous application, after 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. 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.

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. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
   8. Certificates of insurance and insurance policies.
   9. Performance and payment bonds.
   10. Data needed to acquire Owner's insurance.

I. In-Progress Applications for Payment: Administrative actions and submittals that must coincide with submittal of Application for Payment include the following:
   1. Changes to list of subcontractors.
   2. Updated construction schedule.
   3. Updated submittal schedule.
   4. Changes to contractor's staff assignments.
   5. Progress of maintaining record documents.

J. 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.

K. Final Application for Payment: 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 closeout requirements according to Section 01 7700 - Closeout Procedures.
   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. American Institute of Architects Document G706™, "Contractor's Affidavit of Payment of Debts and Claims," 1994 (copy follows this Section).
   5. American Institute of Architects Document G706A™, "Contractor's Affidavit of Release of Liens," 1994 (copy follows this Section).
   6. American Institute of Architects Document G707™, "Consent of Surety to Final Payment," 1994 (copy follows this Section).
   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.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 3100
PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. 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. Requests for Information (RFIs).
   5. Project meetings.

1.2 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information from each other during construction.

1.3 GENERAL PROJECT COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of Contractor's construction schedule.
   2. Preparation of the schedule of values.
   3. Installation and removal of temporary facilities and controls.
   4. Delivery and processing of submittals.
   5. Progress meetings.
   6. Preinstallation conferences.
   7. Startup and adjustment of systems.
   8. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.4 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
   1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
      a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.

b. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
c. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
d. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
e. Indicate required installation sequences.
f. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

A. Key Personnel Names:
1. Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site.
2. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses.
3. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
4. Post copies of list in project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI.
1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. RFI Forms: Form to be used is American Institute of Architects Document G716™, "Request for Information (RFI)," 2004 (copy follows this Section)

C. Architect's Action: Architect will review each RFI, determine action required, and respond. Allow 7 working days for Architect's response for each RFI. RFIs received by Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be returned without action:
a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for coordination information already indicated in the Contract Documents.
d. Requests for adjustments in the Contract Time or the Contract Sum.
e. Requests for interpretation of Architect's actions on submittals.
f. Incomplete RFIs or inaccurately prepared RFIs.
2. Architect's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
3. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 2600 - Contract Modification Procedures.
a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.

D. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within 7 days if Contractor disagrees with response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log with Contractor's Application for Payment. Include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Architect's response was received.
8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

1.7 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: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within 3 days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Lines of communications.
      f. Procedures for processing field decisions and Change Orders.
      g. Procedures for RFIs.
      h. Procedures for testing and inspecting.
      i. Procedures for processing Applications for Payment.
      j. Distribution of the Contract Documents.
      k. Submittal procedures.
      l. Sustainable design requirements.
      m. Preparation of record documents.
      n. Use of the premises.
      o. Work restrictions.
      p. Working hours.
      q. Owner's occupancy requirements.
      r. Responsibility for temporary facilities and controls.
      s. Procedures for moisture and mold control.
      t. Procedures for disruptions and shutdowns.
      u. Construction waste management and recycling.
      v. Parking availability.
      w. Office, work, and storage areas.
      x. Equipment deliveries and priorities.
      y. First aid.
      z. Security.
      aa. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.
      j. Compatibility problems.
      k. Time schedules.
      l. Weather limitations.
      m. Manufacturer's written recommendations.
      n. Warranty requirements.
      o. Compatibility of materials.
      p. Acceptability of substrates.
      q. Temporary facilities and controls.
      r. Space and access limitations.
      s. Regulations of authorities having jurisdiction.
      t. Testing and inspecting requirements.
      u. Installation procedures.
      v. Coordination with other work.
      w. Required performance results.
      x. Protection of adjacent work.
      y. Protection of construction and personnel.
   3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
   5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a Project closeout conference, at a time convenient to Owner and Architect, but no later than 30 days prior to the scheduled date of Substantial Completion.
   1. Conduct the conference to review requirements and responsibilities related to Project closeout.
   2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
      a. Preparation of record documents.
      b. Procedures required prior to inspection for Substantial Completion and for final

inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing sustainable design documentation.
e. Requirements for preparing operations and maintenance data.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Owner's partial occupancy requirements.
k. Installation of Owner's furniture, fixtures, and equipment.
l. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at biweekly intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. 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 meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. 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) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
5. 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.

F. Coordination Meetings: Conduct Project coordination meetings at appropriate intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as

progress meetings and preinstallation conferences.

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 meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined 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. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    c. Review present and future needs of each contractor 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.
3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

SECTION 01 3200
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for documenting progress of construction during performance of the Work.

1.2 SUBMITTALS

A. Submittals Schedule: Submit following information in a tabular format:
   1. Scheduled date for first submittal.
   2. Specification Section number and title.
   3. Submittal category (action or informational).
   4. Name of subcontractor.
   5. Description of the Work covered.
   6. Scheduled date for Architect's final release or approval.

B. Contractor's Construction Schedule: Submit schedule for entire construction period.

1.3 COORDINATION

A. 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.
   1. Secure time commitments for performing critical elements of the Work from parties involved.
   2. Coordinate each construction activity with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 SUBMITTALS SCHEDULE

A. Preparation: Schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
   1. Coordinate Submittals Schedule with Schedule of Values and Contractor's Construction Schedule.
   2. Initial Submittal: Submit concurrently with preliminary construction schedule.
   3. Update Submittal: Submit concurrently with the update submittal of Contractor's Construction Schedule.

3.2 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

B. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.

C. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.

E. 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.

F. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

G. Schedule Preparation: Prepare a list of all activities required to complete the Work.
   1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for activities.
   2. Processing: Process data to produce output data or a computer-drawn, time-scaled

network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the schedule within the limitations of the Contract Time.

3. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

H. Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate Actual Completion percentage for each activity.

I. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.
   a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
   b. Submit value summary printouts one week before each regularly scheduled progress meeting.

3.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. High and low temperatures and general weather conditions.
5. Accidents.
6. Meetings and significant decisions.
7. Unusual events (refer to special reports).
8. Stoppages, delays, shortages, and losses.
9. Meter readings and similar recordings.
10. Emergency procedures.
11. Orders and requests of authorities having jurisdiction.
12. Change Orders received and implemented.
13. Construction Change Directives received.
14. Services connected and disconnected.
15. Equipment or system tests and startups.
16. Partial Completions and occupancies.
17. Substantial Completions authorized.

B. Material Location Reports:

1. At monthly intervals, prepare a comprehensive list of materials delivered to and stored at Project site.
2. List shall be cumulative, showing materials previously reported plus items recently delivered.
3. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.

C. Field Condition Reports:

1. Immediately on discovery of a difference between field conditions and the Contract Documents, prepare a detailed report.

2. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

D. Reporting Unusual Events:
1. When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report.
2. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information.
3. Advise Owner in advance when these events are known or predictable.

3.4 CONSTRUCTION PHOTOGRAPHS

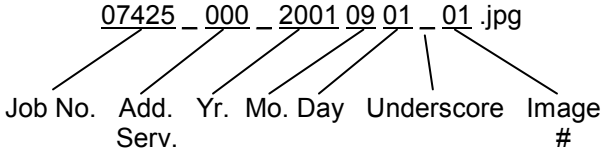
A. General: Document construction progress with digital images.

B. Minimum Digital Camera Resolution: 1800 x 1200 dpi (dots per inch) @ 72 dpi resolution.

C. Acceptable Electronic File Format: .jpg, .tif., .tiff., .tga., jpe., or .png.

D. Date Stamp: Date and time stamp each photograph as it is being taken so stamp is integral to photograph.

E. Image File Naming Convention:



F. Preconstruction Photographs:
1. Before starting construction, take photographs of Project site, existing building, and surrounding properties from different vantage points.
2. Show existing conditions adjacent to property.
3. Submit digital files as required under “Submittals” Article.

G. Periodic Construction Photographs:
1. Take photographs of Work monthly, coinciding with cutoff date associated with each Application for Payment.
2. Select vantage points to best show status of construction and progress since last photographs were taken.
3. Submit digital files as required under “Submittals” Article.

H. Final Completion Construction Photographs:
1. Take photographs after date of Substantial Completion for submission as Project Record Documents.
2. Submit digital files as required under “Submittals” Article.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 3300
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for submitting action, informational, close-out, and maintenance material submittals.

1.2 SUBMITTAL PROCEDURES

A. 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 Work so processing will not be delayed because of need to review submittals concurrently for coordination. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

B. Submittals Schedule: Comply with requirements in Section 01 3200 - Construction Progress Documentation for list of submittals and time requirements for scheduled performance of related construction activities. No more than 6 submittals may be submitted in one week.

C. 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. No extension of Contract Time will be authorized because of failure to transmit submittals enough in advance of Work to permit processing, including resubmittals.
   1. Initial Review: Allow 21 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
   2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
   3. Resubmittal Review: Allow 21 days for review of each resubmittal.
   4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 28 days for initial review of each submittal.
   5. Concurrent Consultant Review: Where Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 21 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
   6. All submittals shall be delivered to WHJ office before review time shall begin. Submittals received after 1:00pm shall be considered received the next day.
   7. All submittals that require color choices shall be submitted to Architect in two (2) groups. One for interior and one for exterior color/material selection so that coordinated color selections can be made for the building.

D. Identification: Place a permanent label or title block on each submittal for identification.
   1. Indicate name of firm or entity that prepared each submittal on label or title block.
   2. Provide a space approximately 6 by 8 in on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
   3. Include the following information on label for processing and recording action taken:
      a. Project name.
      b. Date.
      c. Name and address of Architect.
      d. Name and address of Contractor.
      e. Name and address of subcontractor.
      f. Name and address of supplier.
      g. Name of manufacturer.
      h. Submittal number or other unique identifier, including revision identifier.
      i. Number and title of appropriate Specification Section.
      j. Drawing number and detail references, as appropriate.

k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

E. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in Contract Documents, initial submittal may serve as final submittal.
1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect.
2. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.

G. Transmittal:
1. Transmit all submittals electronically in Adobe Acrobat (.pdf) format unless otherwise specified or approved in advance by Architect. Submit paper copies only when requested or approved by Architect. Paper copy submittals received without request or approval by Architect shall be returned without review.
2. Submittals shall be transmitted via email. Should file size preclude use of email, an alternate method of electronic delivery shall be used as approved by the Architect. The Subject line of the email should read generally as follows: Project Name-Submittals-Section Number-Section Name. If the quantity of included submittals is too great to list in the subject, provide a list in the body of the email.
3. File naming conventions for .pdf files shall be as follows: “Project Name-Submittal-Section Number-Revision Number-Section name.pdf”.
4. Physical samples of products shall be transmitted under separate cover as indicated in item 2.2.D below.
5. Prepare each electronic submittal in the appropriate format individually by Specification Section. Email using the appropriate Subject and include properly formatted transmittal forms.
6. Package each sample submittal appropriately for handling and include a transmittal form.
7. Architect will return submittals, without review, received from sources other than Contractor.
8. Transmittal Form: Provide locations on form for following information:
a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number.
k. Submittal and transmittal distribution record.
l. Remarks.
m. Signature of transmitter.
9. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.

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. Show distribution on transmittal forms.

J. Use for Construction: Use only final submittals with mark indicating action taken by Architect.

PART 2 - PRODUCTS

2.1 GENERAL

A. Contractor's Responsibility: Prepare and submit Action, Informational, Close-Out, and Maintenance Material Submittals required by individual Specification Sections.

B. Quantity of Submittals: Number of copies of submittals as determined during Pre-Construction Conference.

C. Material Safety Data Sheets (MSDSs): Do not submit to Architect. Architect will not review if included in submittals.

2.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's technical information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as shop drawings, not as product data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include following information, as applicable:
    a. Manufacturer's written recommendations.
    b. Manufacturer's product specifications.
    c. Manufacturer's installation instructions.
    d. Standard color charts.
    e. Manufacturer's catalog information.
    f. Wiring diagrams showing factory-installed wiring.
    g. Printed performance curves.
    h. Operational range diagrams.
    i. Mill reports.
    j. Standard product operation and maintenance manuals.
    k. Compliance with specified referenced standards.
    l. Testing by recognized testing agency.
    m. Application of testing agency labels and seals.
    n. Notation of coordination requirements.
4. Submit product data before or concurrent with samples.

B. Preliminary Shop Drawings: Prior to preparation of full shop drawings, prepare project-specific graphic information drawn accurately to scale illustrating brief overview of major elements, pertinent information, and major details of system that will be subsequently expanded in greater detail in full shop drawings.

C. Shop Drawings: Project-specific graphic information drawn accurately to scale. Do not base shop drawings on reproductions of Contract Documents.

1. Preparation: Fully illustrate requirements in Contract Documents. Include following information, as applicable:
    a. Dimensions.
    b. Identification of products.
    c. Fabrication and installation drawings.
    d. Roughing-in and setting diagrams.
    e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.
    f. Shopwork manufacturing instructions.
    g. Templates and patterns.
    h. Schedules.
    i. Delegated engineering calculations.
    j. Compliance with specified standards.
    k. Notation of coordination requirements.
    l. Notation of dimensions established by field measurement.
    m. Relationship to adjoining construction clearly indicated.

n. Seal and signature of delegated engineering professional if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit shop drawings on sheets at least 8-1/2 by 11 in but no larger than 30 by 40 in.

D. Samples: Actual component to be delivered and installed for review of kind, color, pattern, and texture for checking characteristics with other elements and for a comparison of these characteristics between submittal and actual component.

1. Identification: Attach label on unexposed side of sample that includes following, as applicable:
   a. Generic description of sample.
   b. Product name and name of manufacturer.
   c. Sample source.
   d. Number and title of appropriate Specification Section.
2. Disposition: Maintain sets of approved samples at site, available for quality-control comparisons throughout course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into Work must be in undamaged condition at time of installation.
   b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are property of Contractor.
3. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing full range of colors, textures, and patterns available.
4. Samples for Verification: Size indicated in individual Specification Sections, prepared from same material to be used for Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected.
   a. Samples include, but are not limited to, following:
      1) Partial sections of manufactured or fabricated components.
      2) Small cuts or containers of materials.
      3) Complete units of repetitively used materials.
      4) Swatches showing color, texture, and pattern.
      5) Color range sets.
      6) Components used for independent testing and inspection.
   b. Submit a single sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
   c. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a sample, submit sets of paired units that show approximate limits of variations.

E. Product Schedule: Written summary indicating types of products required for Work and their intended location. Include the following information in tabular form, as applicable:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

F. Warranty: Manufacturer’s standard warranty modified as specified. Include statements that supplement or extend warranties contained in Conditions of the Contract.

2.3 INFORMATIONAL SUBMITTALS

A. Installer Certifications: Written statements on manufacturer's letterhead certifying that Installer complies with requirements in Contract Documents and, where required, is authorized by manufacturer for this specific Project.

B. Welding Certifications: Written certification that welding procedures and personnel comply with requirements in the Contract Documents.

C. Manufacturers Project Acceptance Certifications: Written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in Contract Documents, notarized and signed by an individual authorized to sign documents. Include evidence of manufacturing experience where required.

D. Delegated Engineering Calculations: Written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations.

E. Fire Rated Assembly Design Classification: Written evidence from independent testing agency acceptable to authorities having jurisdiction that assembly complies with fire resistance ratings.

F. Building Code Evaluation Reports: Written evidence, from model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include following information, as applicable:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

G. Pre-Construction Test Reports: Written reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

H. Product Test Reports: Written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

I. Source Quality Control Test Reports: Written reports by qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed at manufacturing or fabrication source of product, for compliance with requirements in the Contract Documents.

J. Field Quality Control Test Reports: Written reports by qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

K. Delegated Engineering Field Inspection Reports: Written information documenting delegated engineering professional’s inspections.

L. Manufacturer's Field Inspection Reports: Written information documenting factory-authorized service representative's tests and inspections. Include following, as applicable:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement on condition of substrates and their acceptability for installation of product.
   3. Statement that products at Project site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Other required items indicated in individual Specification Sections.

M. Installer Qualifications: Written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

2.4 CLOSE-OUT SUBMITTALS

A. Maintenance Contracts: Executed service agreements for use in facility operation and maintenance.

B. Maintenance Instructions: Written and graphic instructions and procedures for operation and normal maintenance of products and equipment.

C. Bonds: Written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any,

and term of the coverage.

D. Software: Extra copies of operating system and other utility software necessary to operate and maintain installed software during expected life of operating systems.

2.5 MAINTENANCE MATERIAL SUBMITTALS

A. Useable Products Remaining After Construction: Products purchased but not included in Work.

B. Extra Stock Materials: Products for use in facility operation and maintenance to replace worn or deteriorated installed products.

C. Tools: Specialized and unique hand tools, or other similar devices, necessary for use in facility operation and maintenance not normally available commercially.

D. Equipment: Specialized and unique equipment necessary for use in facility operation and maintenance not normally available commercially.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and 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:

1. Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
2. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
3. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

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. Description of each action provided at Pre-Construction Meeting.

C. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

D. Close-Out Submittals: Architect will review each submittal and will forward to Owner.

E. Maintenance Material Submittals: Deliver to Owner and forward inventory list to Architect.

END OF SECTION

SECTION 01 4000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. 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. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
2. Requirements for Contractor to provide quality-control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

C. See Sections for specific test and inspection requirements.

1.2 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. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

1.3 DELEGATED ENGINEERING

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1.4 SUBMITTALS

A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Delegated Engineering Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.

C. 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.

D. 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. Fabricator Qualifications: A firm experienced in producing products 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. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated. Requirement for specialists shall not supersede building codes and similar regulations governing the Work, nor interfere with local trade-union jurisdictional settlements and similar conventions.

G. 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.

1.6 QUALITY CONTROL

A. Contractor Responsibilities: Engage a qualified testing agency to perform quality-control services specified and required by authorities having jurisdiction.

1. Testing agency will notify Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Testing agency will submit a certified written report of each test, inspection, and similar quality-control service and to authorities having jurisdiction.
3. Testing agency will submit a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Testing agency will interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Testing agency will retest and reinspect corrected work.

B. 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.

C. 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.

D. Testing Agency Responsibilities: Cooperate with Architect and Owner in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Owner promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Interpret tests and inspections and state in each report whether tested and inspected

work complies with or deviates from requirements.

3. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service.
4. Do not release, revoke, alter, or increase requirements of the Contract Documents or approve or accept any portion of the Work.
5. Do not perform any duties of Contractor.

E. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field-curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

F. 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.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

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.
2. Comply with the Contract Document requirements for Section 01 7329 – Cutting and 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

THIS PAGE INTENTIONALLY BLANK

SECTION 01 4200
REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Reference standards, definitions and specification format and content.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. Indicated: The term “indicated” refers to requirements expressed by graphic representations, or in written form on Drawings, in Specifications, and in other Contract Documents. Terms such as “shown”, “noted”, “scheduled”, and “specified” are used to help the user locate the reference.

C. Directed: The term “directed” is a command or instruction by Architect. Other terms including “requested,” “authorized,” “selected,” “approved,” and “permitted” have the same meaning as “directed.”

D. Approved: The term “approved”, when used to convey Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

E. Regulations: The term “regulations” includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. Furnish: The term “furnish” means supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install: The term “install” describes operations at Project site including unloading, temporary storage, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. Provide: The term “provide” means to furnish and install, complete and ready for the intended use.

I. Submitted: The terms “submitted”, “reported”, “satisfactory” and similar words and phrases means submitted to Architect, reported to Architect and similar phrases.

J. Installer: An “Installer” is the Contractor or another entity engaged by the Contractor, as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

K. Experienced: The term “experienced”, when used with an entity, means having successfully completed a minimum of ten previous projects similar in size and scope to this Project; being familiar with the special requirements indicated, and having complied with requirements of authority having jurisdiction.

L. Trades: Using terms such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter". It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

M. Project Site: The term "Project site" means the space available for performing construction activities. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

N. Testing Agencies: A “testing agency” is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

1.3 SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format: These Specifications are organized into Divisions and Sections based on CSI/CSC’s “Master Format” numbering system.

B. 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: This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in

particular situations. These conventions are as follows:

1. Abbreviated Language: Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicates.
2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subjective language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
3. 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.

1.4 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with the standards in effect as of the date of the Contract Documents, unless otherwise indicated.

C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.

D. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Architect for a decision before proceeding.

E. Copies of Standards: Each entity engaged in construction on the Project must be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where other Sections of the Specifications require that a product, material, or installation complies with specified industry standard, the Contractor shall obtain copies directly from the publication source, and submit copies of standards at same time as submittal of other specified submittals.

F. Industry Organization Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications and other Contract Documents they shall mean the name of a trade association, standards-developing organization or other entity in the context of referencing a standard or publication. The following abbreviations and acronyms, as referenced in the Contract Documents, mean the associated names.

1. Names and Web site addresses are subject to change and are believed, but not assured, to be accurate and up to date as of the date of Contract Documents.
2. Refer to Gale Research’s "Encyclopedia of Associations," or Columbia Book’s “National Trade and Professional Association of the U.S.”.

G. Code Agency Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the following entities. Names and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

H. Federal Government Agency Abbreviations and Acronyms: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the following entities. Names and Web site addresses are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 5000
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for support facilities and security and protection facilities.

1.2 SUBMITTALS

A. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

B. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage, including delivery, handling, and storage provisions for materials subject to water absorption or water damage, discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged Work.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of Owner, Architect, and construction personnel office activities and to accommodate project meetings specified in other Division 01 Sections. Keep office clean and orderly. Furnish and equip offices as follows:

1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
2. Conference room of sufficient size to accommodate meetings of 10 individuals. Provide electrical power service and 120 V ac duplex receptacles, with not less than 1 receptacle on each wall. Furnish room with conference table, chairs, and 4 foot square tack and marker boards.
3. Drinking water and private toilet.
4. Coffee machine and supplies.
5. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
6. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
7. Provide a computer, digital camera, printer, copier and high speed internet connection. Computer shall have e-mail capability and be able to transfer photos from the digital camera via e-mail to Architect.

C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

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 by progress of the Work.

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.
   1. Protect existing site improvements to remain including curbs, pavement, and utilities.
   2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Provide temporary parking areas for construction personnel.

E. Project Identification and Temporary Signs: Prepare project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
   1. Engage an experienced sign painter to apply graphics for project identification signs. Comply with details indicated.
   2. Prepare temporary signs to provide directional information to construction personnel and visitors.
   3. Sign Description:
      a. Layout to be provided after award.
      b. Size: 4 ft by 8 ft.
      c. Background Color: white
      d. Logo: Reproduce from proofs provided by Owner.
      e. Building Rendering: Reproduce from digital image provided by Architect.
      f. Text to include:
         1) Project name.
         2) Bond program.
         3) Architect name and address.
         4) Contractor name and address.
         5) Informational phone number.
      g. Letter Style: Helvetica / black.
      h. Mounting: Direct burial.
      i. Material: 3/4 inch thick medium density fiberboard and 4 by 4 inch preservative treated posts.
   4. Installation: Install sign level, plumb and at height and location directed by Architect.
   5. Cleaning and Protection:
      a. Protect sign from damage throughout project.
      b. Immediately repair damage to sign.
      c. Maintain cleanliness of sign at all times.

F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
   1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
   2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
   3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
   4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

C. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

D. Pest Control: Engage pest-control service to recommend practices to minimize attraction and

harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Obtain extended warranty for Owner. Perform control operations lawfully, using environmentally safe materials.

E. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

G. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.4 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
   1. Protect porous materials from water damage.
   2. Protect stored and installed material from flowing or standing water.
   3. Keep porous and organic materials from coming into prolonged contact with concrete.
   4. Remove standing water from decks.
   5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
   1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
   2. Keep interior spaces reasonably clean and protected from water damage.
   3. Periodically collect and remove waste containing cellulose or other organic matter.
   4. Discard or replace water-damaged material.
   5. Do not install material that is wet.
   6. Discard, replace or clean stored or installed material that begins to grow mold.
   7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
   1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
   2. Use permanent HVAC system to control humidity.
   3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
      a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
      b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than

allowed. Report findings in writing to Architect.

c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or 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.

1. Materials and facilities that constitute temporary facilities are property of Contractor.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 7700 - Closeout Procedures.

END OF SECTION

SECTION 01 5100
TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for temporary utilities, including but not limited to, the following:
   1. Sewers and drainage.
   2. Water service and distribution.
   3. Heating and cooling facilities.
   4. Ventilation.
   5. Electric power service.
   6. Lighting.
   7. Telephone service.
   8. Fire protection.

1.2 USE CHARGES

A. General: Cost or use charges for temporary utilities are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary utilities without cost, including, but not limited to, the following:
   1. Testing agencies.
   2. Personnel of authorities having jurisdiction.

B. Sewer Service: Pay sewer service use charges for sewer usage, by all parties engaged in construction, at Project site.

C. Water Service: Pay water service use charges, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site.

D. 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.

1.3 SUBMITTALS

A. Temporary Utility Reports: Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

B. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.

1.4 QUALITY ASSURANCE

A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
   1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
   2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, the following:
   1. Building Code requirements.
   2. Health and safety regulations.
   3. Utility company regulations.
   4. Police, Fire Department and Rescue Squad rules.
   5. Environmental protection regulations.
   6. City ordinances and regulations.

1.5 PROJECT CONDITIONS

A. Permanent Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary facilities to use of permanent facilities.
   1. Temporary Use of Permanent Facilities: Installer of each permanent service shall

assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

B. Conditions of Use: The following conditions apply to use of temporary utilities by all parties engaged in the Work:
   1. Operate in a safe and efficient manner.
   2. Take necessary fire prevention measures.
   3. Do not overload system, or permit them to interfere with progress.
   4. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.
   5. Relocate temporary utilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment may be new or used, but must be adequate in capacity for the required usage, must not create unsafe conditions, and must not violate requirements of applicable codes and standards.

B. Fire Extinguishers:
   1. Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
   2. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.

C. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
   1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
   2. Listed and labeled heating units for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction and clean HVAC system as required in Section 01 7700 - Closeout Procedures.

D. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate temporary utilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify utilities as required.

B. Provide each utility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until utilities are no longer needed or are replaced by authorized use of completed permanent utilities.

C. 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.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
   2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
   3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.

D. Storm Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge of effluent, provide containers to remove and dispose of effluent off-site in a lawful manner.
   1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.
   2. Connect temporary sewers to municipal system as directed by sewer department officials.
   3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
   4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.

E. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

F. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction until permanent water service is in use. Sterilize temporary water piping before use.
   1. As soon as water is required at each level, extend service to form a temporary water- and fire-protection standpipe. Provide distribution piping. Space outlets so water can be reached with a 100-foot hose. Provide one hose at each outlet.
   2. Provide pumps to supply a minimum of 30-psi static pressure at highest point. Equip pumps with surge and storage tanks and automatic controls to supply water uniformly at reasonable pressures.

G. Heating and Cooling:
   1. 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.
   2. Select equipment that will not have a harmful effect on completed installations or elements being installed.
   3. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.

H. 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. Select equipment from that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

I. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
   1. Install electric power service underground, unless overhead service must be used.
   2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
   3. Connect temporary service to power source, as directed by electric company officials.

J. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
   1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
   2. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage.

Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.

3. Provide metal conduit enclosures or boxes for wiring devices.

K. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
   2. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.

L. Telephone Service: Provide temporary telephone service throughout construction period for common-use facilities used by all personnel engaged in construction activities.

M. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
   1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
      a. Field Offices: Class A stored-pressure water-type extinguishers.
      b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
      c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than two extinguishers on each floor at or near each usable stairwell.
   2. Store combustible materials in containers in fire-safe locations.
   3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
   4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
   5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
   6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
   7. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.2 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary utilities. To minimize waste and abuse, limit availability of temporary utilities to essential and intended uses.

B. Maintenance: Maintain utilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
   1. Maintain operation of temporary heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

C. Termination and Removal: Remove each temporary utility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary utility. Repair damaged Work, clean exposed

surfaces, and replace construction that cannot be satisfactorily repaired.

D. Ownership: Materials and facilities that constitute temporary facilities are the property of Contractor.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 5600
TEMPORARY BARRIERS AND ENCLOSURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Requirements for temporary barriers and enclosures, including but not limited to, following:
   1. Environmental protection.
   2. Tree and plant protection.
   3. Site enclosure fence.
   4. Security enclosure and lockup.
   5. Temporary enclosures.

1.2 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to, following:
   1. Building Code requirements.
   2. Health and safety regulations.
   3. Utility company regulations.
   4. Police, Fire Department and Rescue Squad rules.
   5. Environmental protection regulations.
   6. City ordinances and regulations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.

B. Chain-Link Fencing: Minimum 2 inch, 0.148 inch thick, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8 inch OD line posts and 2-7/8 inch OD corner and pull posts, with 1-5/8 inch OD top rail.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide each barrier and enclosure ready for use when needed to avoid delay. Maintain and modify as required by Work progress. Do not remove until barriers and enclosures are no longer needed or are replaced by authorized use of completed permanent facilities.

B. Environmental Protection: Provide protection and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

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.

D. Site Enclosure Fence: Before construction operations begin install chain-link enclosure fence with lockable entrance gates. Enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
   1. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
   2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

F. Temporary Enclosures: Provide temporary enclosures for protection of 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.
2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.

3.2 OPERATION, TERMINATION, AND REMOVAL

A. Maintenance: Maintain facilities in good operating condition until removal.

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

1. Materials that constitute temporary barriers and enclosures are the property of Contractor.
2. At Substantial Completion, clean and renovate permanent barriers and enclosures used during construction period. Comply with final cleaning requirements in Section 01 7700 - CLOSEOUT PROCEDURES.

END OF SECTION

SECTION 01 5713
TEMPORARY EROSION AND SEDIMENT CONTROL DURING CONSTRUCTION

PART 1 – GENERAL

1.1 SUMMARY:

A. Temporary measures required to control erosion and sediment during construction. This includes measures to meet the requirements of the National Pollution Discharge Elimination System (NPDES) administered by the Texas Commission on Environmental Quality (TCEQ).
B. Temporary hay bale dike.
C. Stabilized construction entrance.
D. Silt fence.
E. Rock check dam.
F. Sediment basin with stone and pipe outlet.
G. Diversion dike.
H. Storm Water Pollution Prevention Plan Example (SWP3).

1.2 RELATED SECTIONS:

A. Grass seeding for slope protection and erosion control - Section 32 9200.
B. Site clearing and grubbing - Section 31 1000.
C. Grading and earthwork - Sections 31 2000, 31 2200, and 31 2300.

1.3 REFERENCES:

A. ASTM D3786 - Hydraulic Bursting Strength of Knitted Goods and Non-woven Fabrics. (Mullen Burst)
B. ASTM D3787 - Bursting Strength of Knitted Goods; Constant Rate of Traverse (CRT) Ball Burst Test.
C. ASTM D4355 - Deterioration of Geotextiles From Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
D. ASTM D4491 - Water Permeability of Geotextiles by Permittivity.
E. ASTM D4533 - Index Trapezoidal Tearing Strength of Geotextiles.
F. ASTM D4632 - Grab Breaking Load and Elongation of Geotextiles. (Tensile Strength)
G. ASTM D4751 - Determining the Apparent Opening Size of a Geotextile.
H. ASTM A116 - Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric.
I. ASTM D698 - Test for Moisture Density Relations for Soils (Standard).
J. Texas Department of Transportation (TxDOT) 2004 Standard Specifications for Construction of Highways, Streets, and Bridges. Measurement and payment sections do not apply.
    1) Item 432 - Rip Rap.

1.4 SUBMITTALS:

A. Procedures for Submittals: Section 01 3300.
B. Product Data:
    1) Silt fencing.
    2) Non-woven filter fabric.
    3) Erosion control and revegetation mat
C. Prepare and submit an SWP3 to accompany the erosion control plan included.
D. Inspection Reports and Certificates:
    1) Submit periodic inspection reports and certificates required for SWP3.
    2) Submit Contractor/Subcontractor certifications required for SWP3.
E. Submit revisions or modifications to the erosion control plan and SWP3.

1.5 MAINTENANCE:

A. Maintain erosion control devices as necessary to comply with NPDES. This includes any revisions or modifications to the plan. Any work required for modifications, revisions and maintenance shall be the responsibility of the Contractor and shall not be a basis for additional compensation.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. Hay bales, if used, shall weigh a minimum of fifty (50) pounds and shall be at least thirty (30) inches in length. Bales shall be composed entirely of vegetable matter and be free of seeds. Binding shall be either wire or nylon string, jute or cotton binding is unacceptable. Bales shall be used for not more than two months before being replaced. However, if weather conditions cause biological degradation of the hay bales, they shall be replaced sooner than the two month time period to prevent a loss of structural integrity of the hay bale dike.

B. Stone material at all drainage structures shall consist of stone rip-rap conforming to TxDOT Standard Specification Item 432 and shall have gradation and be placed as shown on the plans and in a layer of at least 24 inches thick. Stone material for rock check dams shall consist of only well graded crushed rock, 4-8 inches in diameter, and shall be placed as detailed on plans. Stone material for stabilized construction exit shall consist of 3" to 5" crushed rock mixed with Type "A" Flexbase to create a drivable surface and shall be placed as shown on the plans.

C. Geotextile Fabrics located as shown in plans shall be a non-woven polypropylene fabric designed specifically for use as a soil filtration media. Fabric shall have an approximate weight of 8 oz/yd2, and shall conform to the following:

Designation	Topic	Value 1
ASTM D4632	Grab Tensile Strength (lbs.)	200
ASTM D4632	Grab Elongation (%)	50
ASTM D4533	Trapezoidal Tear Strength (lbs.)	75
ASTM D3786	Mullen Burst Strength (psi)	400
ASTM D3787	Puncture Strength (lbs.)	125

ASTM D4751 Apparent Opening Size (AOS):

For Soils in Which:	**AOS:**
50% or less passes a #200 mesh sieve	Greater than a #30 sieve
More than 50% passes a #200 mesh sieve	Greater than a #50 sieve

ASTM D4491	Permeability (k):
For Soils in Which:	**AOS:**
Critical/Severe:	k (fabric) >10k (soil)
Normal Applications:	k (fabric) >k (soil)

Value 1 to be used for fabric underlying rock rip rap.
Representative Manufacturer: Value 1: Mirafi, Inc. (1100N), Amoco (4553) or owner approved equal.

D. Geotextile Silt Fence Fabric shall be a nylon reinforced polypropylene woven fabric having a reinforcing cord running the entire length to the top edge of the fabric. The fabric must meet or exceed the following criteria:

Test Designation	Topic	Value
ASTM D4632	Grab Strength (lbs.)	100
ASTM D4632	Grab Elongation (%)	20
ASTM D4533	Trapezoid Tear Strength (lbs.)	60
ASTM D3786	Mullen Burst Strength (lbs.)	200
ASTM D4751	Apparent Opening Size (AOS)	U.S. sieve No. 20-50
ASTM D4491	Permittivity	0.2 $sec.^{-1}$
ASTM D4355	U.V Resistance (500 hours exposure)	80% Min.

Representative Manufacturer: Mirafi, Inc. silt fence, Amoco (2130) or owner approved equal.

E. Fence Posts for Silt Fence shall be galvanized steel "T" posts of sufficient length to support the silt fence system.

F. Woven Wire Support for Silt Fence: W1.4 x W1.4, 4" x 4", zinc coated (galvanized) steel woven wire fabric conforming to ASTM A116.

G. Corrugated Metal Pipe: 18 gage helical wound galvanized corrugated metal pipe.

PART 3 – EXECUTION

3.1 EXAMINATION AND PREPARATION:

A. Review the erosion and sediment control plan provided and modify as required for the Contractor's construction sequence. Modifications shall maintain conformance with the Contractor's storm water pollution prevention plan and the requirements of NPDES. Work and materials required for installation, modification and maintenance of the Erosion Control System shall be incidental to the contract.

B. Locate and protect survey horizontal and vertical control.

3.2 TEMPORARY HAY BALE DIKE:

A. Install where shown on the plans or as needed for erosion control.

B. Hay bales shall be embedded a minimum of four (4) inches and securely anchored using 3/8-inch diameter steel stakes or 2" x 2" wood stakes driven through the bales into the ground a minimum of six (6) inches. Hay bales are to be placed end to end directly adjacent to one another leaving no gap between them.

C. Hay bale dikes are to be used in locations receiving overland sheet flow only.

3.3 STABILIZED CONSTRUCTION EXIT

A. A temporary construction exit shall be installed at any point where traffic will be leaving the construction site to a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction exit is to reduce or eliminate the tracking or flowing of sediment onto public rights-of-way. The exit must be properly graded or incorporate a drainage swale to prevent runoff from leaving the construction site. The length of the exit shall be as required, but not less than 100 feet and the width shall be at least 15 feet for one way traffic and 30 feet for two way traffic. The stabilized exit shall be constructed of rock as described in 2.1.B. and shall be completely underlined with geotextile filter fabric described in 2.1.C, Value 1.

B. The temporary construction exit shall be maintained in a condition which will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic top dressing with additional stone as conditions demand and repair and/or clean out of any measures used to trap sediment. All sediment spilled, dropped, washed or tracked onto public rights-of-way must be removed immediately by the Contractor.

C. When necessary, wheels must be washed or brushed to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done on an area stabilized with crushed stone which drains into an approved sediment trap or sediment basin. All sediment shall be prevented from entering any storm drain, ditch or watercourse using approved methods.

3.4 SILT FENCE:

A. Silt Fence: Shall consist of nylon reinforced polypropylene woven fabric supported by woven wire mesh, W1.4 x W1.4 and galvanized steel posts set a minimum depth of 2 feet and spaced not more than 6 feet on center. A 6-inch wide trench is to be cut 6 inches deep at the toe of the fence on the uphill side to allow the fabric to be laid below the surface and back filled with gravel. Fabric shall have a 6-inch, double overlap securely fastened at a post at abutting ends, and shall be joined such that no leakage or bypass occurs. Remove accumulated sediment when the depth of sediment reaches 6 inches.

3.5 ROCK CHECK DAM:

A. Rock Check Dams shall be constructed at locations shown on the plans and in swales as needed to reduce velocity in swales. Geotextile fabric as described in 2.1.C., Value 1 shall be placed beneath the rock and shall conform to these specifications. Rock shall conform to these specifications.

3.6 DIVERSION DIKE:

A. Diversion dikes, if used by the Contractor, shall be installed prior to and maintained for the duration of construction and shall intercept no more than five (5) acres of runoff. Dikes shall have a minimum top width of 2'-0" and a minimum height of compacted fill of 18" measured from the top of the existing ground at the upslope toe to top of the dike and having side slopes of 3:1 or flatter. The channel which is formed by the dike must have a minimum slope of one (1) percent for the entire length to an outlet. When the slope exceeds three (3) percent, or

velocities exceed one foot per second (regardless of slope), stone stabilization (TxDOT Item 432 Stone (Common)) is required. Reference Section 32 9200 for grass.

3.7 STORM WATER POLLUTION PREVENTION PLAN (SWP3):

A. The attached example SWP3 is provided as a guideline for the Contractor to use in preparing the SWP3 required for this project. The Contractor is responsible for preparation of the required documents, submittal to the EPA of Notice of Intent (NOI) and Notice of Termination(NOT) with a separate Notice of Intnent (NOI) designating the Owner noted as co-permittee, weekly and event inspections, documentation and record keeping, maintenance and repair of the erosion control devices and removal of temporary facilities when permanent facilities are in place and construction is complete.

Storm Water Pollution Prevention Plan (SWP3)

Project Name and Location:

Owner:

Prepared by:

Contractors:

Construction Schedule:
Commencement: **Completion:**

I. Site Description

A. Location and Nature of Construction Activity

- Describe location and type of work.

B. Sequence of Activities

- Describe sequence of soil disturbing activities.

C. Affected Area

- Describe area and reference plan sheet.
- Include area where Contractor may borrow material on-site.

D. Storm Water Discharge Characteristics

- Describe soil and runoff characteristics. Prepare table showing drainage areas and runoff coefficients. (See example table.)

Sub-Area	Acres	Existing "C"	CxA	Proposed "C"	CxA
1					
2					
3					
TOTALS					

TABLE 1: WEIGHTED "C" VALUE CALCULATION

E. Site Maps

- Describe drawings.

F. Name of Receiving Water

- Name drainage system.

II. Federal, State and Local Laws and Regulations

All of the following laws and regulations concerning environmental protection, pollution control, and abatement shall be observed on this project:

Environmental Protection Agency 40CFR Part 122
Executive Order 11514, Protection and Enhancement of Environmental Quality, 5 March, 1970, as amended by Executive Order 11991, 24 May 1977.

Executive Order 11593, Protection and Enhancement of the Cultural Environment, 13 May 1971.

Executive Order 11988, Floodplain Management, 24 May 1977.

Executive Order 11990, Protection of Wetlands, 24 May 1977.

Clean Air Act as amended.

Clean Water Act.

Endangered Species Act of 1973 as amended.

Federal Water Project Recreation Action Act.

Fish and Wildlife Coordination Act.

Historic Sites Act 1935, as amended.

National Historic Preservation Act of 1969, as amended.

Preservation of Historical and Archaeological Data Act of 1974, as amended.

River and Harbor Act, 3 March 1989.

Wild and Scenic Rivers Act of 1968.

Navigable Waters, Discharge of Dredged or Fill Materials, (40 CFR 230.1-230.8).

Regulations for Implementing the Procedural Provisions of National Environmental Policy Act of 1969, (40 CFR 1500-1508).

Protection of Historic and Cultural Properties (30 CFR 800).

Regulatory Programs of the Corps of Engineers (23 CFR 320-329).

Texas Clean Air Act.

III. Pollution Prevention Controls

A. Erosion and Sedimentation Controls

- Describe temporary controls, maintenance and final stabilization.

B. Pollution Removal Efficiencies

- Develop table showing effectiveness of various temporary erosion control methods.

C. Other Controls

- Describe methods for solid waste disposal, hazardous wastes, temporary sanitary facilities, etc.

D. Maintenance

- Describe maintenance procedures.

IV. Inspections

- Describe inspections to be performed including frequency, reporting, and record keeping.

V. Non-Storm Water Discharges

- Describe types of chemical and other agents used in construction.

A. Inventory for Pollution Prevention Plan

- Describe spill prevention methods including good housekeeping measures, hazardous material handling procedures, and specific material and spill prevention practices. Prepare a table outlining these specific practices.

VI. Subcontractors

- Describe subcontractor compliance with SWP3.

VII. Documentation

- Describe record keeping practices and terms. List records to retain.

STORM WATER POLLUTION PREVENTION PLAN
INSPECTION REPORT

Date:_____ Inspector:_____

Job No.:_____ Location:_____

Project:_____

Temp:____ Rain: Yes____ No____ Inches____ Last Rainfall (Date):_____

Ground Condition:_____ Photos taken: Yes ____ No ____

Work in Progress:_____

_____

DISTURBED AREAS

Location	Date Last Disturbed	Next Disturbance	Type of Stabilization	Maintenance Required (Yes/No)

Observed Problems or Hazards:_____

_____

Maintenance Required:_____

_____

_____

Maintenance to be performed on or before:_____

Signature:_____
Inspector

Inspection Report Certification should be attached

INSPECTION REPORT CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed:_____

Title:_____

Date:_____

STORM WATER POLLUTION PREVENTION PLAN

CONTRACTOR/SUBCONTRACTOR CERTIFICATION

I CERTIFY UNDER PENALTY OF LAW THAT I UNDERSTAND THE TERMS AND CONDITIONS OF THE GENERAL NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT THAT AUTHORIZES THE STORM WATER DISCHARGES ASSOCIATED WITH INDUSTRIAL ACTIVITY FROM THE CONSTRUCTION SITE IDENTIFIED AS PART OF THIS CERTIFICATION.

SIGNATURE OF COMPANY OFFICIAL: BY _____

TITLE: ITS _____

DATE: _____

CONTRACTOR: _____

ADDRESS: _____

_____

PHONE NO: _____

SITE:

PROJECT:

3.8 NOTICE OF INTENT (NOI), NOTICE OF TERMINATION (NOT):

A. Contractor shall submit all required Notice(s) of Intent (NOI) at least 48 hours prior to the start of construction.

B. Contractor shall submit all Notice(s) of Termination (NOT) as required by the NPDES regulations.

3.9 At the close of this contract, the Contractor shall remove the temporary erosion control devices when permanent facilities are in place.

END OF SECTION

SECTION 01 6100
PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for following:
   1. Product delivery, storage, and handling.
   2. Product warranties.
   3. Product selection procedures.
   4. General installation provisions.
   5. Restriction of hazardous substances.

1.2 DEFINITIONS

A. Products: Term “product” includes terms “material,” “equipment,” “system,” “component,” and terms of similar intent.

B. Hazardous Substances Prohibited by Law: Including, but not limited to, any product, material, element, constituent, chemical, substance, compound, or mixture, which is defined in, included under, or regulated by any environmental laws.

C. Environmental Laws: Applicable local, state, and federal laws, rules, ordinances, codes, regulations, and requirements in effect at time Contractor’s services are rendered, any amendments for Contractor’s services rendered after effective date of any such amendments, including, without limitation, following:
   1. The Comprehensive Environmental Response, Compensation and Liability Act of 1980.
   2. The Resource Conservation and Recovery Act.
   3. The Toxic Substances Control Act.
   4. The Clean Water Act.
   5. The Clean Air Act.
   6. The Marine Protection Research and Sanctuaries Act.
   7. The Occupational Safety and Health Act.
   8. The Superfund Amendments and Reauthorization Act of 1986.
   9. The Environmental Protection Agency.
   10. Other state superlien or environmental clean-up or disclosure statutes including all state and local counterparts of such.

1.3 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between 2 or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Restriction of Hazardous Substances Compliance: Contractor shall take whatever measures deemed necessary to insure that employees, suppliers, vendors, fabricators, subcontractors, or their assigns, comply with restriction requirements for hazardous substance.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. General: Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions

B. Delivery and Handling:
   1. Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
   3. Deliver products to site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
   4. Inspect products on delivery to determine compliance with Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.5 PRODUCT WARRANTIES

A. General: Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.
   1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
   2. Special Warranty: Written warranty required by Contract Documents to provide specific rights for Owner.

B. Special Warranties: Written document that contains appropriate terms and identification, ready for execution.
   1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
   2. Specified Form: When specified forms are included with Specifications, prepare a written document using indicated form properly executed.
   3. Refer to individual Specification Sections for specific content requirements and particular requirements for submitting special warranties.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with Contract Documents, are undamaged and, unless otherwise indicated, 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. If standard products are available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
   3. Owner reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
   4. Where products are accompanied by term "as selected," Architect will make selection.
   5. Descriptive, performance, and reference standard requirements in Specifications establish salient characteristics of products.
   6. Use of phrase “or equal” shall be defined as “or equivalent as judged by Architect.”

B. “Acceptable Manufacturers” or “Acceptable Manufacturers and Products”:
   1. Where Specifications include a list of named manufacturers and products that are acceptable, provide any product from that list that complies with requirements of Contract Documents.
   2. Manufacturers and products that can be used are restricted to those on list.
   3. Manufacturers and products not included on list are considered substitutions.

C. “Available Manufacturers” or “Available Manufacturers and Products”:
   1. Where Specifications include a list of named manufacturers and products that are known to be available, provide any product from that list, or a product from an unnamed manufacturer, that complies with requirements of Contract Documents.
   2. Manufacturers and products that can be used are not restricted to those on list.
   3. Manufacturers and products not included on list are not considered substitutions.

D. “Basis of Design”:
   1. Use of phrase “Product Standard” or similar phrase shall be defined as “Basis of Design.”

2. When Specifications name a single manufacturer and product, it is to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics, for purposes of evaluating other named manufacturers and products. Drawings and Specifications indicate and specify characteristics that are based on “Basis of Design” manufacturer and product. Other acceptable or available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change intent of Contract Documents as judged by Architect.
3. If Specification includes a list of “Acceptable Manufacturers” or “Acceptable Manufacturers and Products,” provide named “Basis of Design” product or any product from that list that complies with requirements of Contract Documents.
4. If Specification includes a list of “Available Manufacturers” or “Available Manufacturers and Products,” provide named “Basis of Design” product or any product from that list, or a product from an unnamed manufacturer, that complies with requirements of Contract Documents.
5. If Specification does not include a list of either “Acceptable Manufacturers and Products” or “Available Manufacturers and Products,” any product that complies with requirements of Contract Documents may be used.

E. “Required Manufacturer” or “Required Manufacturer and Product”:
1. Where Specifications name a single, required manufacturer and product, only that manufacturer and product may be used.
2. Any other manufacturer and product is considered a substitution.

F. Visual Matching Specification: Where Specifications include phrase “match Architect's sample” or similar phrase, provide a product that complies with requirements of Contract Documents and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

G. Visual Selection Specification: Where Specifications include phrase “as selected by Architect from manufacturer's full range” or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION PROVISIONS

A. Manufacturer’s Instructions:
1. Comply with manufacturer's installation instructions and recommendations, to extent that instructions and recommendations are more explicit or stringent than requirements in Contract Documents.
2. Handle, install, connect, clean, condition and adjust products according to manufacturer's instructions and in conformity with specified requirements.
   a. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with manufacturer for further instructions.
   b. Do not proceed with Work without clear instructions.
3. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by manufacturer.

B. Product Inspection: Inspect products immediately upon delivery and again prior to installation. Reject damaged and defective items.

C. Weather Conditions: Install each component during weather conditions and Project status that will ensure best possible results. Isolate each part of completed construction from incompatible product or material as necessary to prevent deterioration.

3.2 RESTRICTION OF HAZARDOUS SUBSTANCES

A. Contractor agrees that it shall not knowingly, after reasonable diligence and effort, incorporate into Work any hazardous substance other than as may be lawfully contained within products, except in accordance with applicable environmental laws. Further, in performing any of its obligations hereunder, Contractor shall not cause any release of hazardous substances into, or contamination of environment, including soil, atmosphere, any watercourse or ground water, except in accordance with applicable environmental laws. In the event that Contractor engages

in any of activities prohibited in this paragraph, to fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner and its partners, members, officers, directors, agents, employees and consultants from and against any and all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorney's fees, arising out of, incidental to or resulting from the activities prohibited.

B. In the event Contractor observes on site any substance which Contractor reasonably believes to be a hazardous substance, and which is being introduced into the Work, or exists on site, in a manner that violates applicable environmental laws, Contractor shall immediately notify Owner and report condition to Owner in writing. Work in affected area shall not thereafter be resumed except by written authorization of Owner if in fact a hazardous substance has been encountered and has not been rendered harmless. In the event that Contractor fails to give Owner proper notification hereunder, upon knowingly observing a hazardous substance at site, to fullest extent permitted by law, Contractor hereby indemnifies and holds harmless Owner, and all of its partners, members, officers, directors, agents, employees and consultants from and against all claims, damages, losses, causes of action, suits and liabilities of every kind, including, but not limited to, expenses of litigation, court costs, punitive damages and attorneys' fees, arising out of, incidental to, or resulting from Contractor's failure to stop the Work.

C. If Owner believes that hazardous substances may have been located, generated, manufactured, used or disposed of on or about site by Contractor or any of its employees, agents, subcontractors, suppliers, or invitees, Owner may have environmental studies of site conducted as it deems appropriate, and Contractor shall be responsible for cost of such studies to extent that Contractor or any of its employees, agents, subcontractors, suppliers or invitees are responsible for the presence of any hazardous substances.

END OF SECTION

SECTION 01 7300
EXECUTION REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. 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. Coordination of Owner-installed products.
   5. Progress cleaning.
   6. Starting and adjusting.
   7. Protection of installed construction.
   8. Correction of the Work.

1.2 SUBMITTALS

A. Qualification Data: For land surveyor or professional engineer 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. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

D. Certified Surveys: Submit signed and sealed by land surveyor or professional engineer.

E. Final Property Survey: Submit showing the Work performed and record survey data.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: Engage a professional land surveyor or engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions:
   1. The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed.
   2. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
   3. Before construction, verify the location and points of connection of utility services.

B. Existing Utilities:
   1. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed.
   2. Before beginning sitework, investigate and verify the existence and location of underground utilities and other construction affecting the Work.
   3. 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.
   4. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

C. Acceptance of Conditions:
   1. Examine substrates, areas, and conditions, with Installer or Applicator present for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
   3. Examine roughing-in for mechanical and electrical systems to verify actual locations of

connections before equipment and fixture installation.

4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information:
   1. Furnish information to local utility company that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction.
   2. Coordinate with authorities having jurisdiction.

B. Existing Utility Interruptions:
   1. 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:
   2. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
   3. Do not proceed with utility interruptions without Owner's written permission.

C. Field Measurements:
   1. Take field measurements as required to fit the Work properly.
   2. Recheck measurements before installing each product.
   3. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication.
   4. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

E. Review of Contract Documents and Field Conditions:
   1. Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect.
   2. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

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. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
   1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
   2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   3. Inform installers of lines and levels to which they must comply.
   4. Check the location, level and plumb, of every major element as the Work progresses.
   5. Notify Architect when deviations from required lines and levels exceed allowable tolerances.
   6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.

D. Building Lines and Levels:
   1. Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work.
   2. Transfer survey markings and elevations for use with control lines and levels.
   3. Level foundations and piers from two or more locations.

E. Record Log:
   1. Maintain a log of layout control work.

2. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used.
3. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

A. Reference Points:
1. Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work.
2. Preserve and protect permanent benchmarks and control points during construction operations.
3. Do not change or relocate existing benchmarks or control points. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
4. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

B. Benchmarks:
1. Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points.
2. Comply with authorities having jurisdiction for type and size of benchmark.
3. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
4. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
5. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

C. Certified Survey: On completion of foundation, slab, bearing walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

D. Final Property Survey:
1. Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
2. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
3. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

A. General:
1. Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
2. Make vertical work plumb and make horizontal work level.
3. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
4. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.

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. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

F. Anchors and Fasteners:
1. Provide anchors and fasteners as required to anchor each component securely in place,

accurately located and aligned with other portions of the Work.
2. Where mounting heights are not indicated, mount components at heights recommended by industry standards.
3. Allow for building movement, including thermal expansion and contraction.

G. Joints:
1. Make joints of uniform width.
2. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect.
3. Fit exposed connections together to form hairline joints.

H. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction forces.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General:
1. Clean Project site and work areas daily, including common areas.
2. Coordinate progress cleaning for joint-use areas where more than one installer has worked.
3. Enforce requirements strictly.
4. Dispose of materials lawfully.
5. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
6. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
7. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas:
1. Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
2. Remove liquid spills promptly.
3. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work:
1. Keep installed work clean.
2. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended.
3. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Cutting and Patching:
1. Clean areas and spaces where cutting and patching are performed.
2. Completely remove paint, mortar, oils, putty, and similar materials.

3. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.

H. 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.

I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

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.

D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Section 01 4000 - Quality Requirements.

3.9 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.

3.10 CORRECTION OF THE WORK

A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Section 01 7329 - Cutting and Patching. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.

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

THIS PAGE INTENTIONALLY BLANK

SECTION 01 7329
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Procedural requirements for cutting and patching.

1.2 DEFINITIONS

A. Cutting: Removal of existing construction necessary to permit installation or performance of other Work.

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

A. Cutting and Patching Proposal: Submit a proposal describing procedures for major cutting and patching at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:

1. Extent: Describe cutting and patching, show how it will be performed, and indicate why it cannot be avoided.
2. Changes to Existing Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.
3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities: List utilities that cutting and patching procedures will disturb or affect. List utilities that will be relocated and those that will be temporarily out of service. Indicate how long service will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.

B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

C. Miscellaneous Elements: Do not cut and patch elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

D. Visual Requirements:

1. Do not cut and patch construction in a manner that results in visual evidence of cutting and patching.
2. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities.
3. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
4. If possible, retain original Installer or fabricator to cut and patch exposed Work listed below. If it is impossible to engage original Installer or fabricator, engage another recognized, experienced, and specialized firm.

E. Cutting and Patching Conference:

1. Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades.
2. Review areas of potential interference and conflict.
3. Coordinate procedures and resolve potential conflicts before proceeding.

1.5 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Specification Sections.

B. Existing Materials:

1. Use materials identical to existing materials.
2. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
3. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
2. Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Services: Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to avoid interruption of services to occupied areas.

3.3 PERFORMANCE

A. General:

1. Employ skilled workers to perform cutting and patching.
2. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
3. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting:

1. Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction.
2. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
3. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
4. Cut or drill existing finished surfaces from the exposed or finished side into concealed surfaces.
5. Cut concrete and masonry using a cutting machine, such as an abrasive saw or a diamond-core drill.
6. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal

remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.

7. Proceed with patching after construction operations requiring cutting are complete.

C. Patching:

1. Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work.
2. Patch with durable seams that are as invisible as possible.
3. Provide materials and comply with installation requirements specified in other Specification Sections.
4. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
5. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
6. Where walls or partitions that are removed 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.
   a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
   b. Patch fire rated assemblies with materials to match existing and maintain assembly fire rating.
7. Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
8. Patch exterior building enclosure components in a manner that restores enclosure to a weathertight condition.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 7700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
   1. Substantial completion.
   2. Final completion.
   3. List of incomplete work (punch list).
   4. Warranties.
   5. Extra materials.
   6. Final cleaning.

1.2 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, 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:
   1. Submit a written request for inspection for Substantial Completion.
   2. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements.
   3. 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.

C. Reinspection:
   1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   2. Results of completed inspection will form the basis of requirements for Final Completion.

1.3 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 Section 01 2900 – 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.

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.

C. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.4 LIST OF INCOMPLETE WORK (PUNCH LIST)

A. Preparation: Submit list of work not complete. 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, starting with exterior areas first and proceeding to interior spaces in order by room number.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.

1.5 WARRANTIES

A. Product Warranties: Start on date of Substantial Completion. Owner may request a later start date on specific equipment that has been identified as incomplete on Substantial Completion date. Such extension shall be made in writing to Contractor from Architect.

B. 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.

C. 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.

D. 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.

B. Extra Materials: Refer to individual Sections for quantities of extra materials.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal & local environmental and antipollution regulations.

B. Cleaning:

1. Employ experienced workers or professional cleaners for final cleaning.
2. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program.
3. Comply with manufacturer's written instructions.
4. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    g. Sweep concrete floors broom-clean in unoccupied spaces.
    h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
    i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
    j. Remove labels that are not permanent.
    k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
    l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    m. Replace parts subject to unusual operating conditions.
    n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
    o. Clean exposed surfaces of diffusers, registers, and grills.
    p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
    q. Leave Project clean and ready for occupancy.

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.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 7810
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for project record documents, including the following:
   1. Record Contract Drawings.
   2. Record Contract Specifications.
   3. Record submittals.

1.2 CLOSEOUT SUBMITTALS

A. Record Contract Drawings:
   1. Initial Submittal: Submit paper copy set of marked-up record contract drawings. Architect will indicate whether general scope information recorded is acceptable.
   2. Final Submittal: When initial submittal is designated acceptable by Architect, submit following:
      a. Paper copy set of marked-up record contract drawings.
      b. Electronic files of marked-up record contract drawings.
      c. Paper copy plot of each electronic drawing file, whether or not changes and additional information were recorded.

B. Record Contract Specifications:
   1. Initial Submittal: Submit paper copy set of marked-up record contract specifications. Architect will indicate whether general scope of information recorded is acceptable.
   2. Final Submittal: When initial submittal is designated acceptable by Architect, submit following:
      a. Paper copy set of marked-up record contract drawings.
      b. Electronic files of marked-up record contract drawings.

C. Record Submittals: Submit electronic files and directories of each submittal. Include images of approved samples and mock-ups with descriptive information for products and materials.

D. Other Specified Record Information: Submit electronic files and directories of other record information requirements, specified in individual Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROJECT RECORD DOCUMENTS, GENERAL

A. Procedures: Maintain one copy of Contract Drawings, Contract Specifications, and each submittal during construction for project record document purposes.
   1. Post changes and modifications as they occur; do not wait until end of Project.
   2. Protect according to following:
      a. Store in field office apart from Contract Documents used for construction.
      b. Do not use for construction purposes.
      c. Maintain in good order and in a clean, dry, legible condition, protected from deterioration and loss.
   3. Require installers, subcontractors, suppliers, and similar entities, to provide record information.

B. Electronic Format: Scan in PDF, and organize information into separate electronic files that correspond to following:
   1. Contract Drawings: Each sheet; each file identified with sheet number and name.
   2. Contract Specifications: Each section; each file identified with section number and name.
   3. Submittals: Each individual submittal; each file identified with submittal number and name.

3.2 RECORD CONTRACT DRAWINGS

A. Preparation: Accurately mark to show conditions and information that varies from that indicated originally.
   1. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.

2. Accurately record information in an acceptable drawing technique.
3. Record data as soon as possible after obtaining it.
4. Record and check the markup before enclosing concealed installations.
5. Cross-reference to corresponding archive photographic documentation.
6. Use various colors to distinguish between changes for different categories of Work.

B. Content: Types of items requiring marking include, but are not limited to, following:
1. Dimensional changes to Contract Drawings.
2. Revisions to details shown on Contract Drawings.
3. Depths of foundations below first floor.
4. Locations and depths of underground utilities.
5. Revisions to routing of piping and conduits.
6. Revisions to electrical circuitry.
7. Actual equipment locations.
8. Duct size and routing.
9. Locations of concealed internal utilities.
10. Changes made by Change Order.
11. Changes made following Architect's written orders.
12. Details not on original Contract Drawings.
13. Field records for variable and concealed conditions.
14. Record information on the Work that is shown only schematically.

C. Other Specified Requirements: Assemble information specified by individual Specification Sections for record information in connection with actual performance of Work.

D. Identification: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

3.3 RECORD CONTRACT SPECIFICATIONS

A. Preparation: Accurately mark to show conditions and information that varies from that specified originally, and indicate actual materials, products, and equipment installed.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, installer, and other information necessary to provide a record of selections made.

3.4 RECORD SUBMITTALS

A. Preparation: Accurately mark to show conditions and information that varies from that required by approved submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in materials, products, and equipment delivered to site and changes in manufacturer's written instructions for installation.

END OF SECTION

SECTION 01 7820
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for preparing operation and maintenance manuals, including following:
   1. Emergency manual.
   2. Operation manual.
   3. Product maintenance manual.
   4. Systems and equipment maintenance manual.

1.2 SUBMITTALS

A. Manual: Submit paper copies and electronic files in PDF format of each manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 MANUALS, GENERAL

A. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
   1. Subject matter included in manual.
   2. Name and address of Project.
   3. Name and address of Owner.
   4. Date of submittal.
   5. Name, address, and telephone number of Contractor.
   6. Name and address of Architect.
   7. Cross-reference to related systems in other operation and maintenance manuals.

B. Table of Contents: List each product included in manual, identified by product name, indexed to content of volume, and cross-referenced to Specification Section number in Project Manual.

C. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
   1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2 by 11 inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
   2. Identify each binder on front and spine, with printed title, Project name, and subject matter of contents; indicate volume number for multiple-volume sets.
   3. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
   4. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
   5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
      a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
      b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate relationship of component parts of equipment and systems and to illustrate control sequence

and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation. Do not use original Project Record Documents

3.2 EMERGENCY MANUALS

A. General: Assemble a manual of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

B. Content: Organize manual into a separate section for type of emergency, emergency instructions, and emergency procedures.

C. Type of Emergency: Where applicable, include instructions and procedures for each system, subsystem, piece of equipment, and component for fire and power failure.

D. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

E. Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

3.3 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and equipment descriptions, operating standards, operating procedures, operating logs, wiring and control diagrams, and license requirements.

B. Descriptions: Include the following:

1. Product name and model number.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include startup, break-in, and control procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; and required sequences for electric or electronic systems.

D. Systems and Equipment Controls: Describe sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

3.4 PRODUCT MAINTENANCE MANUAL

A. General: Assemble a manual of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

B. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

C. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

D. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

E. Maintenance Procedures: Include manufacturer's written recommendations for inspection procedures, types of cleaning agents, methods of cleaning, schedule for cleaning and

maintenance, and repair instructions.

F. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

G. Warranties: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

3.5 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

A. General: Assemble a manual of maintenance data of each system, subsystem, and piece of equipment not part of a system.

B. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

C. Source Information: List each system, subsystem, and piece of equipment included in the manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

D. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including maintenance instructions, drawings and diagrams for maintenance, nomenclature of parts and components, and recommended spare parts for each component part or piece of equipment.

E. Maintenance Procedures: Include test and inspection instructions, troubleshooting guide, disassembly instructions, and adjusting instructions, and demonstration and training videotape if available, that detail essential maintenance procedures.

F. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

G. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

H. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

I. Warranties: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 01 8200
DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for instructing Owner's personnel, including the following:
   1. Demonstration of operation of systems, subsystems, and equipment.
   2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 SUBMITTALS

A. Instruction Program: Submit two copies of outline of instructional program, including schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1.3 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 4500 – QUALITY CONTROL, experienced in operation and maintenance procedures and training.

C. Preinstruction Conference: Conduct conference at Project site. Review methods and procedures related to demonstration and training.

D. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data have been reviewed and approved by Architect.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
   1. Basis of System Design, Operational Requirements, and Criteria: Include system and equipment descriptions, operating standards, regulatory requirements, equipment function, operating characteristics, limiting conditions, and performance curves.
   2. Documentation: Review emergency, operations, and maintenance manuals; Project Record Documents; identification systems; warranties and bonds; and maintenance service agreements.
   3. Emergencies: Include instructions on stopping; shutdown instructions; operating instructions for conditions outside normal operating limits; instructions on meaning of warnings, trouble indications, and error messages; and required sequences for electric or electronic systems.
   4. Operations: Include startup, break-in, control, and safety procedures; stopping and normal shutdown instructions; routine, normal, seasonal, and weekend operating instructions; operating procedures for emergencies and equipment failure; and required sequences for electric or electronic systems.
   5. Adjustments: Include alignments and checking, noise, vibration, economy, and efficiency adjustments.
   6. Troubleshooting: Include diagnostic instructions and test and inspection procedures.
   7. Maintenance: Include inspection procedures, types of cleaning agents, methods of cleaning, procedures for preventive and routine maintenance, and instruction on use of special tools.
   8. Repairs: Include diagnosis, repair, and disassembly instructions; instructions for identifying parts; and review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.
B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
C. Scheduling:
    1. Provide instruction at mutually agreed on times.
    2. For equipment that requires seasonal operation, provide similar instruction at start of each season.
    3. Schedule training with Owner with at least seven days' advance notice.
D. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

END OF SECTION

SECTION 03 3000
CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.

B. Related Sections:
   1. Section 32 1313 "Concrete Paving" for concrete pavement and walks.
   2. Section 03 5300 "Concrete Topping" for emery- and iron-aggregate concrete floor toppings.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
   1. Location of construction joints is subject to approval of the Architect.

E. Samples: For vapor retarder.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:
   1. Cementitious materials.
   2. Admixtures.
   3. Form-release agents.
   4. Steel reinforcement and accessories.
   5. Waterstops.
   6. Curing compounds.
   7. Floor and slab treatments.
   8. Vapor retarders.

C. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates.

D. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.

E. Field quality-control reports.

F. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

C. Testing Agency Qualifications: An independent agency, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Preinstallation Conference: Conduct conference at Project site.
1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
a. Contractor's superintendent.
b. Independent testing agency responsible for concrete design mixtures.
c. Ready-mix concrete manufacturer.
d. Concrete subcontractor.
2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, shoring and reshoring procedures, vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage. Avoid damaging coatings on steel reinforcement.

B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

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 Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
2. Products: Subject to compliance with requirements, provide one of the products specified.
3. 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 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
1. Plywood, metal, or other approved panel materials.
2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
a. High-density overlay, Class 1 or better.
b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.

c. Structural 1, B-B or better; mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

G. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

H. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

I. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.3 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

C. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.

D. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

E. Deformed-Steel Wire: ASTM A 496/A 496M.

F. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch wire length.

G. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

H. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

I. Epoxy-Coated Welded Wire Reinforcement: ASTM A 884/A 884M, Class A coated, Type 1, plain steel.

2.4 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.

B. Epoxy-Coated Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, ASTM A 775/A 775M epoxy coated.

C. Epoxy Repair Coating: Liquid, two-part, epoxy repair coating; compatible with epoxy coating on reinforcement and complying with ASTM A 775/A 775M.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.5 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II, gray. Contractor may supplement with the following:
      a. Fly Ash: ASTM C 618, Class C or F.

B. Silica Fume: ASTM C 1240, amorphous silica.

C. Normal-Weight Aggregates: ASTM C 33, Class 3M coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: As shown on plans.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494/C 494M, Type C.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Axim Italcementi Group, Inc.; CATEXOL CN-CI.
      b. BASF Construction Chemicals - Building Systems; Rheocrete CNI.
      c. Euclid Chemical Company (The), an RPM company; EUCON CIA.
      d. Grace Construction Products, W. R. Grace & Co.; DCI.
      e. Sika Corporation; Sika CNI.

D. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. BASF Construction Chemicals - Building Systems; Rheocrete 222+.
      b. Cortec Corporation; MCI- [2000] [2005NS].
      c. Grace Construction Products, W. R. Grace & Co.; DCI-S.
      d. Sika Corporation; FerroGard 901.

2.7 WATERSTOPS

A. Flexible Rubber Waterstops: CE CRD-C 513, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Greenstreak.
      b. Williams Products, Inc.
   2. Profile: Ribbed with center bulb.
   3. Dimensions: 6 inches by 3/8 inch thick; nontapered.

B. Flexible PVC Waterstops: CE CRD-C 572, for embedding in concrete to prevent passage of fluids through joints. Factory fabricate corners, intersections, and directional changes.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. BoMetals, Inc.

b. Greenstreak.
c. Paul Murphy Plastics Company.
d. Vinylex Corp.

2. Profile: Ribbed with center bulb.
3. Dimensions: 6 inches by 3/8 inch thick; nontapered.

C. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular or trapezoidal strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Carlisle Coatings & Waterproofing, Inc.; MiraSTOP.
   b. CETCO; Volclay Waterstop-RX.
   c. Concrete Sealants Inc.; Conseal CS-231.
   d. Greenstreak; Swellstop.
   e. Henry Company, Sealants Division; Hydro-Flex.
   f. JP Specialties, Inc.; Earth Shield Type 20.

2.8 VAPOR RETARDERS

A. Sheet Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Stego Industries, LLC; Stego Wrap, 15 mils.

2.9 FLOOR AND SLAB TREATMENTS

A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive, crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 sieve.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Anti-Hydro International, Inc.; Emery.
   b. Dayton Superior Corporation; Emery Tuff Non-Slip.
   c. Lambert Corporation; EMAG-20.
   d. L&M Construction Chemicals, Inc.; Grip It.
   e. Metalcrete Industries; Metco Anti-Skid Aggregate.

2.10 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; that penetrates, hardens, and densifies concrete surfaces.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. ChemMasters; Chemisil Plus.
   b. ChemTec Int'l; ChemTec One.
   c. Conspec by Dayton Superior; Intraseal.
   d. Curecrete Distribution Inc.; Ashford Formula.
   e. Dayton Superior Corporation; Day-Chem Sure Hard (J-17).
   f. Edoco by Dayton Superior; Titan Hard.
   g. Euclid Chemical Company (The), an RPM company; Euco Diamond Hard.
   h. Kaufman Products, Inc.; SureHard.
   i. L&M Construction Chemicals, Inc.; Seal Hard.
   j. Meadows, W. R., Inc.; LIQUI-HARD.
   k. Metalcrete Industries; Floorsaver.
   l. Nox-Crete Products Group; Duro-Nox.
   m. Symons by Dayton Superior; Buff Hard.
   n. US SPEC, Division of US Mix Products Company; US SPEC Industraseal.
   o. Vexcon Chemicals, Inc.; Vexcon StarSeal PS Clear.

2.11 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
   a. Axim Italcementi Group, Inc.; CATEXOL CimFilm.
   b. BASF Construction Chemicals - Building Systems; Confilm.
   c. ChemMasters; SprayFilm.
   d. Conspec by Dayton Superior; Aquafilm.
   e. Dayton Superior Corporation; Sure Film (J-74).
   f. Edoco by Dayton Superior; BurkeFilm.
   g. Euclid Chemical Company (The), an RPM company; Eucobar.
   h. Kaufman Products, Inc.; Vapor-Aid.
   i. Lambert Corporation; LAMBCO Skin.
   j. L&M Construction Chemicals, Inc.; E-CON.
   k. Meadows, W. R., Inc.; EVAPRE.
   l. Metalcrete Industries; Waterhold.
   m. Nox-Crete Products Group; MONOFILM.
   n. Sika Corporation; SikaFilm.
   o. SpecChem, LLC; Spec Film.
   p. Symons by Dayton Superior; Finishing Aid.
   q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
   r. Unitex; PRO-FILM.
   s. Vexcon Chemicals, Inc.; Certi-Vex Envio Set.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
      b. BASF Construction Chemicals - Building Systems; Kure 200.
      c. ChemMasters; Safe-Cure Clear.
      d. Conspec by Dayton Superior; W.B. Resin Cure.
      e. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
      f. Edoco by Dayton Superior; Res X Cure WB.
      g. Euclid Chemical Company (The), an RPM company; Kurez W VOX; TAMMSCURE WB 30C.
      h. Kaufman Products, Inc.; Thinfilm 420.
      i. Lambert Corporation; AQUA KURE - CLEAR.
      j. L&M Construction Chemicals, Inc.; L&M Cure R.
      k. Meadows, W. R., Inc.; 1100-CLEAR.
      l. Nox-Crete Products Group; Resin Cure E.
      m. Right Pointe; Clear Water Resin.
      n. SpecChem, LLC; Spec Rez Clear.
      o. Symons by Dayton Superior; Resi-Chem Clear.
      p. TK Products, Division of Sierra Corporation; TK-2519 DC WB.
      q. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Anti-Hydro International, Inc.; AH Clear Cure WB.
      b. BASF Construction Chemicals - Building Systems; Kure-N-Seal WB.
      c. ChemMasters; Safe-Cure & Seal 20.
      d. Conspec by Dayton Superior; Cure and Seal WB.
      e. Cresset Chemical Company; Crete-Trete 309-VOC Cure & Seal.

f. Dayton Superior Corporation; Safe Cure and Seal (J-18).
g. Edoco by Dayton Superior; Spartan Cote WB II.
h. Euclid Chemical Company (The), an RPM company; Aqua Cure VOX; Clearseal WB 150.
i. Kaufman Products, Inc.; Cure & Seal 309 Emulsion.
j. Lambert Corporation; Glazecote Sealer-20.
k. L&M Construction Chemicals, Inc.; Dress & Seal WB.
l. Meadows, W. R., Inc.; Vocomp-20.
m. Metalcrete Industries; Metcure.
n. Nox-Crete Products Group; Cure & Seal 150E.
o. Symons by Dayton Superior; Cure & Seal 18 Percent E.
p. TK Products, Division of Sierra Corporation; TK-2519 WB.
q. Vexcon Chemicals, Inc.; Starseal 309.

G. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. BASF Construction Chemicals - Building Systems; Kure 1315.
b. ChemMasters; Polyseal WB.
c. Conspec by Dayton Superior; Sealcure 1315 WB.
d. Edoco by Dayton Superior; Cureseal 1315 WB.
e. Euclid Chemical Company (The), an RPM company; Super Diamond Clear VOX; LusterSeal WB 300.
f. Kaufman Products, Inc.; Sure Cure 25 Emulsion.
g. Lambert Corporation; UV Safe Seal.
h. L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
i. Meadows, W. R., Inc.; Vocomp-30.
j. Metalcrete Industries; Metcure 30.
k. Right Pointe; Right Sheen WB30.
l. Symons by Dayton Superior; Cure & Seal 31 Percent E.
m. Vexcon Chemicals, Inc.; Vexcon Starseal 1315.
2. VOC Content: Curing and sealing compounds shall have a VOC content of 200 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.12 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1752, cork or self-expanding cork.
B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
E. Reglets: Fabricate reglets of not less than 0.022-inch thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.13 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.

4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be filled in over a scarified surface to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.14 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 25 percent.
2. Combined Fly Ash and Pozzolan: 25 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to [0.06] [0.15] [0.30] [1.00] percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.15 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Piers: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.50.
3. Slump Limit: 6 inches, plus or minus 1 inch.

B. All Other Elements: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Slump Limit: 4 inches or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Air Content: 4 percent, plus or minus 1.5 percent at point of delivery for 1 inch and 1-1/2-inch nominal maximum aggregate size.
5. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery for 3/4-inch nominal maximum aggregate size.

2.16 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.17 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
   1. Class A, 1/8 inch for smooth-formed finished surfaces.
   2. Class B, 1/4 inch for rough-formed finished surfaces.

D. Construct forms tight enough to prevent loss of concrete mortar.

E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

H. Chamfer exterior corners and edges of permanently exposed concrete.

I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 SHORES AND RESHORES

A. Comply with ACI 318 (ACI 318M) and ACI 301 for design, installation, and removal of shoring and reshoring.

1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.

B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.5 VAPOR RETARDERS

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.

1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.6 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

F. Epoxy-Coated Reinforcement: Repair cut and damaged epoxy coatings with epoxy repair coating according to ASTM D 3963/D 3963M. Use epoxy-coated steel wire ties to fasten epoxy-coated steel reinforcement.

3.7 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
7. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.

D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
   1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
   2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Section 07920 "Joint Sealants," are indicated.
   3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.8 WATERSTOPS

A. Flexible Waterstops: Install in construction joints and at other joints indicated to form a continuous diaphragm. Install in longest lengths practicable. Support and protect exposed waterstops during progress of the Work. Field fabricate joints in waterstops according to manufacturer's written instructions.

B. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated, according to manufacturer's written instructions, adhesive bonding, mechanically fastening, and firmly pressing into place. Install in longest lengths practicable.

3.9 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.

5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.10 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.
2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.

D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.11 FINISHING FLOORS AND SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish and to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing.

C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155 (ASTM E 1155M), for a randomly trafficked floor surface:
      a. Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 17; for slabs-on-grade.
      b. Specified overall values of flatness, F(F) 30; and of levelness, F(L) 20; with minimum local values of flatness, F(F) 24; and of levelness, F(L) 15; for suspended slabs.

D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thin-set method. While concrete is still plastic, slightly scarify surface with a fine broom.
   1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.

E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

F. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish where indicated and to concrete stair treads, platforms, and ramps. Apply according to manufacturer's written instructions and as follows:
   1. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications. Tamp aggregate flush with surface, but do not force below surface.
   2. After broadcasting and tamping, apply float finish.
   3. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

G. Dry-Shake Floor Hardener Finish: After initial floating, apply dry-shake floor hardener to surfaces according to manufacturer's written instructions and as follows:
   1. Uniformly apply dry-shake floor hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer.
   2. Uniformly distribute approximately two-thirds of dry-shake floor hardener over surface by hand or with mechanical spreader, and embed by power floating. Follow power floating with a second dry-shake floor hardener application, uniformly distributing remainder of material, and embed by power floating.
   3. After final floating, apply a trowel finish. Cure concrete with curing compound recommended by dry-shake floor hardener manufacturer and apply immediately after final finishing.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.13 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches , and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
   a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
   b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
   c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.14 LIQUID FLOOR TREATMENTS

A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.

1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
2. Do not apply to concrete that is less than seven days' old.
3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.15 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least six months. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.16 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension to solid concrete. Limit cut depth to 3/4 inch. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
   6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
   7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose

particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.17 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

C. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mixture placed each day.
   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
7. Compression Test Specimens: ASTM C 31/C 31M.
   a. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project

identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. Measure floor and slab flatness and levelness according to ASTM E 1155 (ASTM E 1155M) within 24 hours of finishing.

3.18 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 03 3543
POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Products and procedures for coloring and polishing concrete floors using multi-step wet/dry mechanical process, and accessories indicated, specified, or required to complete processing operations.

1.2 DEFINITIONS

A. Terminology: As defined by CPAA.

B. Polished Concrete: The multi-step operation of mechanically grinding, honing, polishing of a concrete floor surface with bonded abrasives to cut a concrete floor surface and to refine each cut to the maximum potential to achieve a specified level of finished gloss as defined by the CPAA.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's technical data, application instructions, and recommendations.

B. Installer Qualifications: Data for company, principal personnel, experience, and certifications specified in PART 1 "Quality Assurance" Article.

C. Field Quality Control – Dynamic Coefficient of Friction Test Reports: Reports of testing specified in PART 3 "Field Quality Control" Article.

D. Field Quality Control – Static Coefficient of friction test reports: Reports of testing specified in Part 3 "Field Quality Control" article

E. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include instructions for maintenance of polished finish, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.4 QUALITY ASSURANCE

A. Polisher Qualifications:

1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce specified work.
2. Supervision: Maintain competent supervisor who is at Project during times specified work is in progress, and is currently certified as Craftsman - Level 1 or higher by CPAA.
3. Manufacturer Qualification: Approved by manufacturer to apply liquid applied products.

B. Walkway Auditor: Certified by CPAA or NFSI to test polished concrete floors for dynamic and static coefficient of friction according to ANSI B101.1 and B101.3.

C. Coefficient of Friction: Achieve following coefficient of friction by field quality control testing in accordance to the following standards:

1. ANSI B101.1 Static Coefficient of Friction - Achieve a minimum of .42 for level floor surfaces.
2. ANSI B101.3 Dynamic Coefficient of Friction - Achieve a minimum of .35 for level floor surfaces.

D. Field Mock-up: Before performing work of this Section, provide as many field mock-ups required to verify selections made under submittals and to demonstrate aesthetic effects of polishing. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.

1. Grind, hone, and polish 10 ft square floor area for each finish approved under sample submittals; include edges and joints.
2. Use same personnel, including supervisors, who will perform work.
3. Apply products according to specified requirements.
4. Mock-up shall be representative of work to be expected.
5. Finish various components to show maximum variation that will exist in work.

6. Approval is for following aesthetic qualities:
   a. Compliance with approved submittals.
   b. Uniformity of exposed aggregate.
   c. Uniformity of sheen.
   d. Uniformity of color.
7. Obtain Architect's approval before starting work on Project.
8. Protect approved field mock-ups.
9. Maintain field mock-ups during construction in an undisturbed condition as a standard for judging completed work.
10. Do not demolish, alter, or remove field mock-ups until acceptable to Owner and Architect.

E. Pre-Installation of Concrete Conference: Prior to placing concrete for areas scheduled for polishing, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Concrete producer.
   e. Concrete finisher, including supervisor.
   f. Concrete polisher, including supervisor.
   g. Technical representative of liquid applied product manufacturers.
   h. Walkway auditor.
2. Minimum Agenda: Polisher shall demonstrate understanding of work required by reviewing and discussing procedures for, but not limited to, following:
   a. Tour mock-up and representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of procedures, and other preparatory work performed by other installers.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review procedures, including, but not limited to:
      1) Details of each step of grinding, honing, and polishing operations.
      2) Application of liquid applied products.
      3) Protecting concrete floor surfaces until polishing work begins.
      4) Protecting polished concrete floors after polishing work is completed.
3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.5 FIELD CONDITIONS

A. Damage and Stain Prevention: Take following precautions to prevent damage and staining of concrete surfaces to be polished.
1. Prohibit use of markers, spray paint, and soapstone.
2. Prohibit improper application of liquid membrane film forming curing compounds.
3. Prohibit vehicle parking.
4. Prohibit pipe cutting operations.
5. Prohibit storage of products for not less than 28 days after concrete placement.
6. Prohibit ferrous metals storage.
7. Protect from petroleum, oil, hydraulic fluid, or other liquid dripping from equipment.
8. Protect from acids and acidic detergents.
9. Protect from painting activities.

B. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting liquid applied product application.

PART 2 - PRODUCTS

2.1 LIQUID APPLIED PRODUCTS

A. Liquid Densifier: An aqueous solution of silicon dioxide dissolved in one of the following

Hydroxides that penetrates into the concrete surface and reacts with the calcium hydroxide to provide a permanent chemical reaction that hardens and densifies the wear surface of the cementitious portion of the concrete. All of the following have the same chemistry varying only by the alkali used for solubility of the silicon dioxide:

1. Sodium silicate.
2. Potassium silicate.
3. Lithium silicate.
4. Alkalis solution of colloidal silicates or silica.

B. Dyes: Non film forming soluble colorant dissolved in a carrier designed to penetrate and alter coloration and appearance of a concrete floor surface without a chemical reaction.

C. Pigmented Microstains: Fine pigment particles ($<3.9 \times 10^{-4}$ inches) suspended in water-based silicate solution that penetrates concrete and reacts with calcium hydroxide to lock in color particles.

D. Sealer - Impregnating Stain Protection: Non film forming stain and food resistant penetrating sealer designed to be applied to densified and polished concrete which meets the requirements of OSHA for slip resistance as tested by ASTM D 2047 and stain resistance of ASTM D 1308.

2.2 ACCESSORIES

A. Repair Material: A product that is designed to repair cracks and surface imperfections. The specified material must have sufficient bonding capabilities to adhere after the polishing to the concrete surface and provide abrasion resistance equal to or greater than the surrounding concrete substrate. Grout Material: A thin mortar used for filling spaces. Acceptable products shall be:

1. Epoxy, urethane, poluyrea, or polyaspartic resins.
2. Latex or acrylic binders mixed with cement dust from previous grinding steps.
3. Silicate binders mixed with cement dust from previous grinding steps.

B. Protective Cover: Non-woven, puncture and tear resistant, polypropylene fibers laminated with a multi-ply, textured membrane, not less than 18 mils in thickness.

2.3 EQUIPMENT

A. Field Grinding and Polishing Equipment:

1. A multiple head, counter rotating, walk behind or ride on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
2. If dry grinding, honing, or polishing, use dust extraction equipment with flow rate suitable for dust generated, with squeegee attachments.
3. If wet grinding, honing, or polishing, use slurry extraction equipment suitable for slurry removal and containment prior to proper disposal.

B. Edge Grinding and Polishing Equipment: Hand-held or walk-behind machines which produces same results, without noticeable differences, as field grinding and polishing equipment.

C. Burnishing Equipment: High speed walk-behind or ride-on machines capable of generating 1000 to 2000 revolutions per minute and with sufficient head pressure of not less than 20 pounds to raise floor temperature by 20 degrees F.

D. Diamond Tooling: Abrasive tools that contain industrial grade diamonds within a bonded matrix (such as metallic, resinous, ceramic, etc) that are attached to rotating heads to refine the concrete substrate.

1. Bonded Abrasive: Abrasive medium that is held within a bonding that erodes away to expose new abrasive medium as it is used.
2. Metal Bond Tooling: Diamond tooling that contains industrial grade diamonds with a metallic bonded matrix that is attached to rotating heads to refine the concrete substrate. These tools are available in levels of soft, medium, and hard metallic matrices that are matched with contrasting concrete substrates (i.e. hard matrix/soft concrete, medium matrix/medium concrete, soft matrix/hard concrete) and are typically used in the grinding and early honing stages of the polishing process.
3. Resin Bond Tooling: Diamond tooling that contains industrial grade diamonds within a resinous bonded matrix (poly-phenolic, ester-phenolic, thermoplastic-phenolic) that is

attached to rotating heads to refine the concrete substrate. Resin bond tooling does not have the soft/medium/hard characteristics of metal bond tooling and are typically used for the later honing and polishing stages of the polishing process.

4. Hybrid Tooling: Diamond tooling that combines metal bond and resin bond that has the characteristics of both types of tooling. These types of tools are typically used as either transitional tooling from metal bond tools to resin bond tools or as a first cut tool on smooth concrete surfaces.
5. Transitional Tooling: Diamond tooling that is used to refine the scratch pattern of metal bond tooling prior to the application of resin bond tooling in an effort to extend the life of resin bond tooling and to create a better foundation for the polishing process.
6. Abrasive Pad: An abrasive pad, resembling a typical floor maintenance burnishing pad, that has the capability of refining the concrete surface on a microscopic level that may or may not contain industrial grade diamonds. These pads are typically used for the maintenance and/or restoration of previously installed polished concrete flooring.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to be polished for compliance with requirements and other conditions affecting performance.
      a. Concrete Finished Floor Flatness according to applicable Division 03 Section on cast-in-place concrete.
      b. Concrete curing methods according to applicable Division 03 Section on cast-in-place concrete.
      c. Concrete Compression strength per according to applicable Division 03 Section on cast-in-place concrete.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning New Concrete Surfaces:
   1. Prepare and clean concrete surfaces.
   2. Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, paint splatter, and other contaminants incompatible with liquid applied products and polishing.

3.3 VAPOR TESTING CONCRETE FLOORS

A. Alkalinity:
   1. Test Method: Measure pH according to method indicated in ASTM F 710.
   2. Acceptable Results: pH between 8 and 10.
B. Moisture Vapor Transmission Rate:
   1. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
   2. Acceptable Results: Not more than 5 pounds per 1000 square feet in 24 hours.
C. Relative Humidity:
   1. Test Method: Perform relative humidity test using in situ probes according to ASTM F 2170.
   2. Acceptable Results: Not more than 75 percent.

3.4 COLORING CONCRETE FLOORS

A. Dye or Pigmented Microstain Application:
   1. Apply solution by methods and techniques required by manufacturer to produce finish matching approved mock-ups.
   2. Maintain wet edge, working newly applied solution into edges of adjacent wet edges of previously treated surfaces.
   3. Maintain consistent saturation throughout application.
   4. Avoid splashing, dripping, or puddling of solution on adjacent substrates.
   5. When color matches approved mock-ups, neutralize as required by manufacturer

3.5 POLISHING CONCRETE FLOORS

A. General: Perform all polishing procedures to ensure a consistent appearance from wall to wall.

B. Initial Grinding:
   1. Use grinding equipment with metal or semi-metal bonded tooling.
   2. Begin grinding in one direction using sufficient size equipment and diamond tooling to meet specified aggregate exposure class.
   3. Make sequential passes with each pass perpendicular to previous pass using finer grit tool with each pass, up to 100 grit metal bonded tooling.
   4. Achieve maximum refinement with each pass before proceeding to finer grit tools.
   5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.
   6. Continue grinding until aggregate exposure matches approved field mock-ups.

C. Treating Surface Imperfections:
   1. Mix patching compound or grout material with dust created by grinding operations, manufacturer's tint, or sand to match color of adjacent concrete surfaces.
   2. Fill surface imperfections including, but not limited to, holes, surface damage, small and micro cracks, air holes, pop-outs, and voids with grout to eliminate micro pitting in finished work.
   3. Work compound and treatment until color differences between concrete surface and filled surface imperfections are not reasonably noticeable when viewed from 10 feet away under lighting conditions that will be present after construction.

D. Liquid Densifier Application: Apply undiluted to point of rejection, remove excess liquid, and allow to cure according to manufacturers instructions.

E. Grout Grinding:
   1. Use grinding equipment and appropriate grit and bond diamond tooling.
   2. Apply grout, forced into the pore structure of the concrete substrate, to fill surface imperfections.
   3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

F. Honing:
   1. Use grinding equipment with hybrid or resin bonded tooling.
   2. Hone concrete in one direction starting with a 100 grit tooling and make as many sequential passes as required to remove scratches, each pass perpendicular to previous pass, up to 400 grit tooling reaching maximum refinement with each pass before proceeding to finer grit tooling.
   3. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

G. Polishing:
   1. Use polishing equipment with resin bonded tooling.
   2. Begin polishing in one direction starting with 800 grit tooling.
   3. Make sequential passes with each pass perpendicular to previous pass using finer grit tooling with each pass until the specified level of gloss has been achieved.
   4. Achieve maximum refinement with each pass before proceeding to finer grit pads.
   5. Clean floor thoroughly after each pass using dust extraction equipment properly fitted with squeegee attachment or walk behind auto scrubber suitable to remove all visible loose debris and dust.

H. Stain Protection: Uniformly apply and remove excessive liquid according to manufacturer's instructions. Final film thickness should be less than .05 mils after cure.

I. Final Polish: Using burnishing equipment and finest grit abrasive pads, burnish to uniform reflective sheen matching approved field mock-up.

J. Final Polished Concrete Floor Finish:
   1. Aggregate Exposure Class B – Fine Aggregate (Salt and Pepper): Remove not more

than 1/16 inch of concrete surface by grinding and polishing resulting in majority of exposure displaying fine aggregate with no, or small amount of, medium aggregate at random locations.

2. Gloss Finish Level 3 – High Gloss Appearance:
   a. Procedure: Recommended not less than 4 steps with full refinement of each diamond tool with one application of densifier.
   b. Gloss Measurement: Determine the specular gloss by incorporating the following:
      1) Reflective Clarity Reading: Not less than 65 according to ASTM D5767 prior to the application of sealers.
      2) Reflective Sheen Reading: Not less than 35 according to ASTM D523 prior to the application of sealers.

3.6 FIELD QUALITY CONTROL

A. Field Testing: Engage a qualified walkway auditor to perform field testing to determine if polished concrete floor finish complies with specified coefficient of friction:
   1. ANSI B101.1 for static coefficient of friction.
   2. ANSI B101.3 for dynamic coefficient of friction.

3.7 CLOSEOUT ACTIVITIES

A. Maintenance Training: CPAA Craftsman shall train Owner's designated personnel in proper procedures for maintaining polished concrete floor.

3.8 PROTECTION

A. Covering: After completion of polishing, protect polished floors from subsequent construction activities with protective covering.

END OF SECTION

SECTION 04 0526
MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Final cleaning of exposed surfaces of stone, thin stone, and cast stone masonry.

1.2 SUBMITTALS

A. Cleaning Plan: Written plan for cleaning exposed masonry surfaces, prepared by commercial cleaning compound manufacturer, with signature of masonry installer indicating acceptance; include following information:
   1. Qualifications of applicators.
   2. Technical literature for each cleaning product indicated, specified or required; include application procedures.
   3. Masonry surfaces to be cleaned and required preparations.
   4. Sequence of cleaning activities, including precautions, if any.
   5. Environmental requirements by authorities having jurisdiction for use and discharge of cleaning effluents.
   6. Protection of surrounding areas, landscaping, building surfaces adjacent to area of cleaning.

B. Field Quality Control Test Reports: Reports of manufacturers field service required by PART 3 “Field Quality Control” Article.

C. Maintenance Data: For inclusion in maintenance information specified by Section 01 7700 - Closeout Procedures.
   1. Include manufacturer’s instructions for periodic cleaning of masonry, including methods and frequency recommended for maintaining optimum condition under anticipated use.
   2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Manufacturers Technical Representative Qualifications: Direct employee of technical services department of manufacturer of cleaning compounds with not less than 5 years experience in providing recommendations, evaluations, inspections, and problem diagnostics. Sales representatives are not acceptable.

B. Cleaning Mock-up: Prior to pre-cleaning conference, clean not less than 10 square feet of each masonry type.
   1. Use same workers, including supervisors, which will perform work on Project.
   2. Work on mock-ups shall be representative of those to be expected.
   3. Approval is for aesthetic quality of cleaning compounds to remove imperfects and blemishes caused by masonry construction.
   4. Obtain Architect’s approval before starting work of this Section.
   5. Maintain mock-ups during construction in an undisturbed condition as a standard for judging completed Work.

C. Pre-Cleaning Conference: Before beginning Work of this Section, conduct single masonry conference, for this Section and other Masonry Sections, at site to comply with requirements of Division 1 specifications.
   1. Required Attendees:
      a. Owner.
      b. Architect.
      c. Contractor, including superintendent.
      d. Masonry veneer installer, including supervisor.
      e. Thin stone masonry veneer installer, including supervisor.
      f. Cast stone installer, including supervisor.
      g. Cleaning applicator, including supervisor.
      h. Cleaning products manufacturer representative.
   2. Minimum Agenda: Applicator shall demonstrate understanding of Work required by

reviewing and discussing procedures for, but not limited to, following:
a. Tour mock-up and representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions prior to cleaning and after cleaning.
b. Handling, storing and protecting cleaning products.
c. Cleaning procedures, including weather provisions.
d. Evaluation of masonry to be cleaned.
e. Environmental requirements by authorities having jurisdiction for use and discharge of cleaning products.
f. Review sample panels, discuss and evaluate dilution rates, dwell times, number of applications, effects of pressure rinsing, and desired results.
g. Tour project and discuss masonry conditions to be cleaned.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

D. Cleaning Training: Manufacturer's qualified technical representative, not a sales representative, shall train installer's personnel, including supervisor, at Project on proper cleaning procedures prior to start of Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into Work include, but are not limited to, those listed alphabetically below.
1. Diedrich Technologies, Inc.
2. EaCoChem.
3. Prosoco, Inc.

2.2 MASONRY CLEANERS

A. Commercial Cleaning Compounds: Manufacturer formulated cleaner for removing mortar stains, efflorescence, and other construction related stains from new masonry surfaces, with following suitability requirements:
1. Suitable for masonry units and mortar installed, without discoloring or damaging masonry materials.
2. Suitable for conditions at project site, including, but not limited to, windows, doors, other exterior wall elements, and adjacent walks or landscaping.

B. Cleaning Restrictions: Following methods are not acceptable:
1. Hydrochloric acid.
2. Muratic acid.
3. Fan tip pressurized water blasting.
4. Abrasive blasting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine masonry substrates to be cleaned for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance.

3.2 FIELD QUALITY CONTROL

A. Manufacturers Field Service: Qualified technical representative shall be available to provide on-call technical support during entire course of masonry cleaning, and shall periodically inspect masonry cleaning activities to insure cleaning is proceeding in accordance with manufacturer's recommendations and cleaning plan. Representative shall submit written report of each visit indicating observations, findings and conclusions of inspection.

3.3 PROTECTION

A. Adjacent Surfaces: During cleaning operations, protect surrounding areas, landscaping, adjacent surfaces, and vehicles from contact with cleaning products. Avoid drifting of spray

caused by wind.

3.4 CLEANING

A. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Protect adjacent and nearby materials, especially windows and glass, to avoid damage.
2. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
3. Test cleaning methods on sample wall panel; leave one half panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
4. Clean masonry by means recommended by cleaning product manufacturer using masonry cleaner specified.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 04 7200
CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast stone shapes and accessories indicated, specified, or required for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Document Concept: Drawings and Specifications express concept of cast stone masonry work, however, they may not indicate or specify total work that may be required, nor shall they be construed as engineered.

B. Delegated Engineering Responsibility: Employ delegated engineering professional to provide engineering for each member and component, including attachment to building structural frame, required to comply with concept expressed in Contract Documents that includes, but is not limited to, following:

1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on building structural frame.
2. Preparation of engineering calculations, shop drawings, and other submittals with professional seal affixed according to respective jurisdictional licensing regulations.

1.3 PERFORMANCE REQUIREMENTS

A. Wind Criteria: Engineer to withstand load effects of wind acting inward and outward, normal to plane of wall, for wind loads indicated on Drawings.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product indicated, specified, or required.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

B. Shop Drawings: Detailed and dimensioned plans, elevations, and large-scale details showing fabrication and installation details.

1. Include building elevations showing layout of units and locations of joints and anchors.
2. Include profiles and shapes of units.
3. Include details of reinforcement and indication of finished faces.
4. Include anchors and anchoring methods to supporting substrates.

C. Samples for Verification: 10 in square for each color and texture of cast stone specified until approved.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, which has sufficient production capacity to manufacture required units, and is a plant certified by the Cast Stone Institute.

B. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations of cast stone masonry similar to this Project, and, that has a record of successful in-service performance.

C. Source Limitations for Cast Stone: Obtain cast stone units through single source from single manufacturer.

D. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

E. Quality Standards:

1. ASTM C 1364.
2. CSI’s Technical Manual.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.7 PROJECT CONDITIONS

A. Cold-Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.
1. Do not use frozen materials or materials mixed or coated with ice or frost.
2. Do not build on frozen substrates.

B. Hot-Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 PRIMARY MATERIALS FOR CAST STONE

A. Portland Cement: ASTM C 150, Type I or Type III, containing not more than 0.60 percent total alkali when tested according to ASTM C 114. Provide natural color or white cement as required to produce cast stone color indicated.

B. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation and colors as needed to produce required cast stone textures and colors.

C. Fine Aggregates: Natural sand or crushed stone complying with ASTM C 33, gradation and colors as needed to produce required cast stone textures and colors.

D. Admixtures: Use only admixtures specified or approved in writing by Architect.
1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-entraining admixture, ASTM C 260; add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.
4. Water-reducing, retarding, accelerating and high range admixtures, ASTM C 494, Types A – G.

E. Reinforcement:
1. Deformed Steel Bars: ASTM A 615, Grade 40 or 60; use one of following when covered with less than 1-1/2 in of cast stone material.
   a. Epoxy Coating: ASTM A 775.
   b. Galvanized Coating: ASTM A 767.
2. Welded Wire Fabric: ASTM A 185 where applicable for wet cast units.

2.2 FASTENERS AND ANCHORS

A. Selection Criteria:
1. Only domestically manufactured anchors and fasteners are acceptable.
2. Diameter, material thicknesses, and lengths as determined by application, and as indicated below, sufficient to attach or anchor item to substrate indicated without failure.

B. Powder Actuated Fasteners:
1. Product Quality Standard: ANSI A10.3.
2. Product Description: Low velocity, powder actuated fasteners, stainless steel drive pins, length as required for minimum 3/4 in long penetration, with washers sized engage 3 strands of lath; powder loads suitable for application indicated; sufficient to correctly attach or anchor metal lath to substrate indicated without failure.
3. Available Manufacturers:
   a. Hilti Corp.
   b. ITW Ramset/Red Head.
   c. Powers Fasteners.
   d. Simpson Strong Tie Anchor Systems.

C. Screw Fasteners:
1. Product Quality Standard: SAE J429, Grade 5 and ASTM A 449, with following physical properties:
a. Load Bearing Thread Hardness: Not less than HRC 28, nor more than HRC 34.
b. Drill Point and Lead Thread Hardness: Not less than HRC 52.
2. Description: Self-drilling screws with pan or wafer type head of size to engage 3 strands of lath; fabricated from carbon steel with corrosion resistant coating with not less than 800 hours of salt-spray resistance according to ASTM B 117; in lengths required to achieve minimum penetration of 3/8 in beyond metal framing flange.
3. Acceptable Manufacturers and Products:
a. Elco Industries, Inc.; Dril-Flex Structural Fasteners with Silver Stalgard finish.
b. Hilti, Inc.; Kwik-Flex Self-Drilling Fasteners with Kwik-Cote finish.

D. Post-Installed Expansion Anchors:
1. Product Quality Standards: ACI 318, D.1 and ICC-ES AC193; approved for cracked concrete conditions when used in concrete that is cracked or may become cracked under connected load.
2. Material and Finish: ASTM F 593, Group 1, Alloy 304 stainless steel.
3. Acceptable Manufacturers and Products:
a. ITW; Redhead Truebolt Wedge Anchor.
b. Powers; Bull Wedge Anchor.
c. Simpson; Strong-Bolt Wedge Anchor.
4. Not Acceptable: Chemical type anchors.

E. Dowels: Round bars, fabricated from Type 304 stainless steel complying with ASTM A 240, ASTM A 276, or ASTM A 666.

2.3 MORTAR MATERIALS

A. Portland Cement:
1. Product Quality Standard: ASTM C 150, Type I; except Type III may be used for cold-weather construction.
2. Color: Natural gray.

B. Hydrated Lime Product Quality Standard: ASTM C 207, Type S.

C. Masonry Cement and Mortar Cement: ASTM C 91 and ASTM C 1329 products are not acceptable.

D. Aggregate:
1. Product Quality Standard: ASTM C 144.
2. Mortar Exposed to View: Washed aggregate consisting of natural sand or crushed stone.

E. Integral Water Repellent for Mortar:
1. Description: Liquid water repellent mortar admixture intended for use with concrete masonry units, containing integral water repellent by same manufacturer.
2. Available Manufacturers and Products:
a. Addiment Inc.; Mortar Tite.
b. Grace Construction Products; Dry-Block Mortar Admixture.
c. Master Builders, Inc.; Color Cure Mortar Admix or Rheomix Rheopel.

F. Water: Potable.

2.4 JOINT SEALANT AND BACKERS

A. Sealant: Exterior non-sag silicone sealant specified in Section 07 9200 - Joint Sealants.

B. Backers: Foam backer rods and bond-breaker tape specified in other Section 07 9200 - Joint Sealants.

2.5 MORTAR MIXES

A. General: Mix cementitious materials in a mechanical batch mixer with a sufficient amount of water to produce a workable consistency for minimum 3 minutes to 5 minutes; do not hand mix.
1. Admixture Limitation: Do not use admixtures including air-entraining agents, accelerators, retarders, water repellent agents, antifreeze compounds, calcium chloride or other admixtures.
2. Cementitious Limitation: Limit cementitious materials in mortar to portland cement and lime.

3. Ingredient Measurement: Measure in a one cubic foot batching box before mixing for component materials not preblended, prepackaged or containerized.
4. Aggregate Moisture Content: Monitor moisture content of aggregates and exercise caution when mixing to avoid over or understanding of mortar.

B. Mortar Mix:
1. Mix Quality Standard: ASTM C 270, Proportion Specification for portland cement-lime mortars, Type N.
2. Mortar Color: Standard gray.

2.6 MANUFACTURING CAST STONE

A. Performance Criteria: ASTM C 1364.

B. Shop Fabrication: Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.
1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
3. Provide drips on projecting elements unless otherwise indicated.

C. Fabrication Tolerances:
1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 in.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of length of unit or 1/8 in, whichever is greater, but in no case by more than 1/4 in.
3. Warp, Bow, and Twist: Not to exceed 1/360 of length of unit or 1/8 in, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 in on formed surfaces of units and 3/8 in on unformed surfaces.

D. Curing:
1. Cure units in curing chamber according to one of following:
a. At 100 percent relative humidity and temperature of 100 deg F for 12 hours.
b. At 95 percent relative humidity and temperature of 70 deg F for 16 hours.
2. Keep units damp and continue curing for not less than 5 days at mean daily temperature of 70 deg F.
3. Protect units from moisture evaporation with curing blankets or curing compounds after casting.

E. Treatment for Exposed Faces: Acid etch units after curing to remove cement film from surfaces to be exposed to view.

F. Colors and Textures: As selected from manufacturer's standard colors and textures available.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which cast stone will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 SETTING CAST STONE IN MORTAR

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
1. CSI's Technical Manual.
2. Respective manufacturer's written installation instructions.
3. Approved submittals.
4. Contract Documents.

B. Install anchors, supports, and other attachments indicated or necessary to secure units in place using following fasteners:
1. Sheathed Stud Walls: Screw fasteners.
2. Concrete Masonry: Post-installed expansion anchors.

C. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.
   1. Build anchors and ties into mortar joints as units are set.
   2. Fill dowel holes and anchor slots with mortar.
   3. Fill collar joints solid as units are set.
   4. Build concealed flashing into mortar joints as units are set.
   5. Keep head joints in coping and other units with exposed horizontal surfaces open to receive sealant.
   6. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for sealant to depths of not less than 3/4 in. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Provide sealant at joints.
   1. Keep joints free of mortar and other rigid materials.
   2. Form joint of width indicated, but not less than 3/8 in.
   3. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
   4. Prepare and apply sealant to comply with applicable requirements in appropriate Section 07 9200 - Joint Sealants.

G. Tolerances:
   1. Variation from Plumb: Do not exceed 1/8 in in 10 ft, 1/4 in in 20 ft, or more.
   2. Variation from Level: Do not exceed 1/8 in in 10 ft, 1/4 in in 20 ft, or 3/8 in maximum.
   3. Variation in Joint Width: Do not vary joint thickness more than 1/8 in in 36 in or one-fourth of nominal joint width, whichever is less.
   4. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 in.

3.3 ADJUSTING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved samples, complying with other requirements, and showing no evidence of replacement.

3.4 CLEANING

A. In-Progress Cleaning: Clean cast stone as work progresses.
   1. Remove mortar fins and smears.
   2. Remove excess sealant immediately, including spills, smears, and spatter.

B. Final Cleaning: Comply with Section 04 0526 - Masonry Cleaning.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 04 7500
MANUFACTURED STONE VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured stone veneer set in molded-polystyrene back-up panels installed over gypsum sheathing substrates; and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

B. Shop Drawings: Detailed drawings showing proper installation and flashing techniques. Coordinate locations with those found on Drawings.

C. Samples for Verification: Full-size samples for stone units indicated showing full range of exposed color, texture, and dimensions to be expected.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Manufacturer's Authorization: Installer shall be authorized by the manufacturer to install work and shall have completed training offered by manufacturer.
2. Experience: Company experienced in performing specified work similar to scope of this Project, and with a record of successful in-service performance, and sufficient production capability, facilities and personnel, to produce required work.
3. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

B. Field Samples for Aesthetic Purposes: Before beginning work of this Section, build as many field samples as required to verify selections made under submittals and to demonstrate aesthetic effects (not for work execution). Use materials and installation methods specified.

1. Build 48 in square for each type of veneer finish.
2. Locate at locations indicated or, if not indicated, as directed by Architect; facing south.
3. Clean exposed faces with masonry cleaner specified.
4. Notify Architect 7 days in advance of dates and times when panels will be constructed.
5. Protect approved field samples from elements with weather-resistant covering.
6. Maintain during construction in an undisturbed condition as a standard for judging completed work.
7. Approval is for following aesthetic qualities; approval does not constitute approval of deviations from Contract Documents, unless specifically approved by Architect in writing:
   a. Color, texture, and blending of stone units.
   b. Color and blending of mortar.
   c. Relationship of mortar and sealant colors to stone unit colors.
   d. Tooling of joints.
   e. Effectiveness of masonry cleaner.
   f. Other aesthetic qualities as determined by Architect.
8. When directed, demolish and remove field samples from site, including foundations.

C. Pre-Installation Conference: Before beginning work of this Section, conduct conference at site to comply with requirements of applicable Division 01 Sections.

1. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Stone installer, including supervisor.
   e. Cold-formed steel stud framing installer, including supervisor.
   f. Sheathing installer, including supervisor.
   g. Manufacturer's technical representative.
2. Minimum Agenda: Installer shall demonstrate understanding of work required by

reviewing and discussing procedures for, but not limited to, following:

a. Tour representative areas of required work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory work performed by other installers.
b. Review Contract Document requirements.
c. Review approved submittals.
d. Review installation procedures, including, but not limited to:
    1) Handling, storing and protecting products and materials.
    2) Evaluation of substrates on which work will be installed.
    3) Fabrication and placement of flashings.
    4) Preparation and mixing of mortar, including testing.
    5) Installation and attachment of metal lath.
    6) Laying stone units.
    7) Curing.
    8) Protecting installed stone, including stain prevention.
    9) Cleaning installed work.
e. Review required inspection, testing, certifying, and material usage accounting procedures.
f. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Label pallets of stone units with manufacturers name, product name, and information required to identify products.
B. Storage:
1. Stone Units: Store on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
2. Cementitious Materials: Store on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
3. Metal Items: Store to prevent corrosion and accumulation of dirt and oil.

1.5 PROJECT CONDITIONS

A. Stain Prevention: Prevent mortar and soil from staining exposed stone. Immediately remove mortar and soil from exposed stone.
1. Protect base of walls from rain-splashed mud and mortar splatter.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, and other adjacent with painted and integral finishes from mortar droppings.
4. Turn scaffolding planks near work on edge at end of each day to prevent rain from splashing mortar droppings or dirt onto face of exposed stone.
B. Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.
1. Do not use frozen materials or materials mixed or coated with ice or frost.
2. Do not build on frozen substrates.
3. Remove and replace stone damaged by frost or freezing conditions.
C. Warm Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
1. Manufacturer: Oldcastle Architectural Inc.
2. Stone: Waterford Stone.
3. Color: White.

2.2 MATERIALS, GENERAL

A. Defective Units: Do not install units where defects, including dimensions that vary from specified dimensions by more than stated tolerances, will be exposed in completed work or will impair quality of completed work.

B. Source Limitations for Cementitious Materials: Obtain mortar ingredients of a uniform quality from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

2.3 MANUFACTURED STONE UNITS

A. Stone: Manufacturers proprietary ingredients mixed evenly throughout so that color is uniform through unit; hand chiseled textured surface.

B. Polystyrene Backup Panels:

1. Product Standard: ASTM C 578, Type 1.
2. Description:
   a. Polystyrene insulation panels molded to fit shapes of stone selected so that each stone unit can be snapped into the panel allowing the stone unit to be installed flush with the back of the panels.
   b. Backs of polystyrene panels fabricated with grooved drainage channels to allow water to travel to flashing to be drained to exterior.

2.4 CEMENTITIOUS MATERIALS

A. Mortar: ASTM C 270, manufacturers pre-blended, proprietary mix consisting of portland cement and sand.

B. Water: Clean, fresh, potable water, free of mineral or organic matter which can affect based coat, field added.

2.5 EMBEDDED FLASHING MATERIALS

A. Metal Flashing:

1. Material: ASTM A 240 or A 666, Type 304; stainless steel, 2D annealed finish, not less than 0.0250 in (24 ga) thick, unless noted otherwise.
2. Metal Drip Edges: Extending at least 3 inches into wall and 1/2 inch out from wall, with a hemmed outer edge bent down 30 degrees.

B. Rubberized Asphalt Flashing:

1. Description: Minimum 40 mils thick, cold applied, self-adhering sheet consisting of cross-laminated polyethylene film laminated to rubberized asphalt adhesive, with release-paper backing.
2. Surface Primer/Conditioner: Products provided by flashing manufacturer.
3. Available Manufacturers and Products:
   a. Carlisle Coatings & Waterproofing; CCW-705-TWF Thru-Wall Flashing.
   b. Grace Construction Products; Perm-A-Barrier Wall Flashing.
   c. Henry Co., Bakor, Inc.; Blueskin TWF.
   d. Polyguard Products, Inc.; 401 Membrane.
   e. Tamko Building Products; TW-Thru Wall Flashing.
   f. Williams Products, Inc.; Everlastic MF-40.

2.6 INSTALLATION MATERIALS

A. Adhesive Acceptable Manufacturers and Products:

1. ITW TACC Mason Bond.
2. Loctite PL 3000.
3. Gorilla Glue Polyurethane Adhesive.

B. Screw Fasteners:

1. #10 x 3-1/2 inch (minimum) carbon steel self-tapping screw with a flat (countersunk) or bugle head and a minimum shank diameter of 0.190 inches.
2. Corrosion protection equivalent to minimum protection of 750 hours with 10 percent or less red rust when tested according to ASTM B 117.
3. Of sufficient length to penetrate a minimum of 1/2 inch into cold-formed metal framing, or not less than three exposed threads behind the stud flange.

2.7 MORTAR MIXES

A. General: Mix cementitious materials in a mechanical batch mixer with a sufficient amount of

water to produce a workable consistency; do not hand mix.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to which manufactured stone veneer will be applied for compliance with requirements, installation tolerances and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's written installation instructions.
   2. Approved submittals.
   3. Contract Documents.

3.3 INSTALLING EMBEDDED FLASHINGS

A. Design Intent: Drawings may not necessarily indicate or describe full extent of work required for completion of embedded flashings.

B. Preparation: Substrate surfaces shall be smooth and free from projections that could puncture flashing.

C. Installation:
   1. Install sheet metal flashing true to line and levels indicated; minimize quantity of lap joints by using longest units possible.
   2. Set shaped sheet metal units in proper locations with outside hemmed edges flush with building face location indicated.
   3. Install at lintels, ledges, and other obstructions to direction infiltrated water downward in the wall and out via the weeps.
   4. Install rubberized asphalt flashing over sheet metal flashing and extend up wall not less than 6 inches and lap air barrier.

D. Examination and Repair: Immediately prior to plastering work, examine exposed surfaces of flashing and seal penetrations and damaged areas with rubberized asphalt flashing material before covering.

3.4 ADHERING MANUFACTURED STONE UNITS

A. Layout:
   1. Lay out walls in advance for accurate spacing of surface bond patterns, uniform joint thicknesses, accurate location of openings, movement-type joints, returns, and offsets.
   2. Avoid using of less than half-size units at corners, jambs, and where possible at other locations.

B. Polystyrene Backup Panels:
   1. Attach to wall substrate with screws spaced not more than 16 inches on centers vertically and 19 inches on centers horizontally with not less than 1 screw for each 2.1 square feet of wall area.
   2. Install additional screws within 12 inches of window and door openings at intervals of not more than 8 inches on centers around perimeter.
   3. Attach the anchors near the pocket edges so that prongs are visible with stone units in place.
   4. Leave a clearance of 3/8 inch between bottom of polystyrene panels and base of wall and top of lintel to allow for installation of weeps.

C. Stone Units:
   1. At some locations, stone units require cutting before inserting them into the polystyrene pockets; ensure cut surface is not exposed to finished face of wall.
   2. Place the stone unit into the appropriate polystyrene pocket and ensure back face of masonry unit sits flat against the polystyrene panel.

D. Blending of Stone Units: Mix units for exposed stone from several pallets or cubes as they are

placed to produce uniform blend of colors and textures.

E. Work Pattern: Begin work at bottom of wall and proceed up, or begin and proceed down wall, according to manufacturer's instructions.

F. Movement Joints: Locate joints as indicated on Drawings.

G. Built-In Work:
   1. As construction progresses, build in items specified in this and other Sections. Fill in solidly with stone around built-in items.
   2. Fill space between steel frames and stone solidly with mortar, unless otherwise indicated.

H. Joints:
   1. Using a grout bag, fill joints with mortar.
   2. Finish joints that will remain exposed with a tool slightly larger than joint width to form a concave profile. Tool joints after mortar has taken its initial set and in such a manner as to squeeze mortar back into joint.

3.5 INSTALLATION TOLERANCES

A. Variation from Plumb:
   1. For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet.
   2. For external corners, control joints, and other conspicuous lines, do not exceed 1/4 inch in 10 feet or 1/2 inch in 40 feet.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, and other conspicuous lines, do not exceed 1/4 inch in 10 feet or 1/2 inch in 40 feet.

3.6 ADJUSTING

A. Repairs for Damage:
   1. Remove and replace stone units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units.
   2. Install new units to match adjoining units and install fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing:
   1. During tooling of joints, enlarge any voids or holes, except weeps and vents, and completely fill with mortar.
   2. Point up all joints including corners, openings, and adjacent construction, to provide a neat, uniform appearance.
   3. Prepare joints for application of sealants, where indicated.

3.7 CLEANING

A. In-Progress Cleaning: As soon as practical, clean stone as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.

B. Final Cleaning: As specified in Section 04 0526 - Masonry Cleaning.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 05 1200
STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Structural steel.
   2. Grout.

B. Related Sections:
   1. Section 01 4000 "Quality Requirements" for independent testing agency procedures and administrative requirements.
   2. Section 05 3100 "Steel Decking" for field installation of shear connectors through deck.
   3. Section 05 5000 "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame and other metal items not defined as structural steel.
   4. Section 05 5100 "Metal Stairs."

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

B. Heavy Sections: Rolled and built-up sections as follows:
   1. Shapes included in ASTM A 6/A 6M with flanges thicker than 1-1/2 inches.
   2. Welded built-up members with plates thicker than 2 inches.
   3. Column base plates thicker than 2 inches.

1.4 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of simple shear connections required by the Contract Documents to be selected or completed by structural-steel fabricator, including comprehensive engineering analysis by a qualified professional engineer, to withstand loads indicated and comply with other information and restrictions indicated.
   1. Select and complete connections using schematic details indicated and AISC 360.
   2. Use LRFD; data are given at factored-load level.

B. Moment Connections: Type FR, fully restrained.

C. Construction: Combined system of moment frame, braced frame, and shear walls.

1.5 ACTION SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.
   1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
   2. Include embedment drawings.
   3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
   4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical high-strength bolted connections.
   5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint qualified by testing, including the following:
   1. Power source (constant current or constant voltage).
   2. Electrode manufacturer and trade name, for demand critical welds.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Welding certificates.

C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

D. Mill test reports for structural steel, including chemical and physical properties.
E. Product Test Reports: For the following:
1. Direct-tension indicators.
2. Tension-control, high-strength bolt-nut-washer assemblies.
3. Nonshrink grout.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.
B. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category CSE.
C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
1. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
E. Comply with applicable provisions of the following specifications and documents:
1. AISC 303.
2. AISC 341 and AISC 341s1.
3. AISC 360.
4. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."
F. Preinstallation Conference: Conduct conference at Project site.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
2. Clean and relubricate bolts and nuts that become dry or rusty before use.
3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

1.9 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992/A 992M.
B. Channels, Angles: ASTM A 36/A 36M.
C. Plate and Bar: ASTM A 36/A 36M.
D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.
E. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B.
1. Weight Class: Standard.
2. Finish: Black except where indicated to be galvanized.
F. Welding Electrodes: Comply with AWS requirements.

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade C, (ASTM A 563M, Class 8S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers; all with plain finish.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

B. High-Strength Bolts, Nuts, and Washers: ASTM A 490 (ASTM A 490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with splined ends; ASTM A 563, Grade DH, (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers with plain finish.
1. Direct-Tension Indicators: ASTM F 959, Type 490 (ASTM F 959M, Type 10.9), compressible-washer type with plain finish.

C. Zinc-Coated High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy-hex steel structural bolts; ASTM A 563, Grade DH (ASTM A 563M, Class 10S) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M), Type 1, hardened carbon-steel washers.
1. Finish: Hot-dip zinc coating.
2. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with mechanically deposited zinc coating finish.

D. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F 1852, Type 1, heavy-hex head assemblies consisting of steel structural bolts with splined ends, heavy-hex carbon-steel nuts, and hardened carbon-steel washers.
1. Finish: Plain.

E. Shear Connectors: ASTM A 108, Grades 1015 through 1020, headed-stud type, cold-finished carbon steel; AWS D1.1/D1.1M, Type B.

F. Unheaded Anchor Rods: ASTM F 1554, Grade 55, weldable.
1. Configuration: Straight.
2. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
3. Plate Washers: ASTM A 36/A 36M carbon steel.
4. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
5. Finish: Plain.

G. Threaded Rods: ASTM A 36/A 36M.
1. Nuts: ASTM A 563 (ASTM A 563M) heavy-hex carbon steel.
2. Washers: ASTM F 436 (ASTM F 436M), Type 1, hardened carbon steel.
3. Finish: Plain.

H. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1030.

I. Sleeve Nuts: Made from cold-finished carbon steel bars, ASTM A 108, Grade 1018.

2.3 PRIMER

A. Primer: SSPC-Paint 25, zinc oxide, alkyd, linseed oil primer.

B. Galvanizing Repair Paint: ASTM A 780.

2.4 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.5 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC 360.
1. Camber structural-steel members where indicated.
2. Fabricate beams with rolling camber up.
3. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.
4. Mark and match-mark materials for field assembly.
5. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 1, "Solvent Cleaning."

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

G. Steel Wall-Opening Framing: Select true and straight members for fabricating steel wall-opening framing to be attached to structural steel. Straighten as required to provide uniform, square, and true members in completed wall framing.

H. Welded Door Frames: Build up welded door frames attached to structural steel. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk machine screws, uniformly spaced not more than 10 inches o.c. unless otherwise indicated.

I. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.
   2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.6 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.7 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Surfaces to receive sprayed fire-resistive materials (applied fireproofing).
   5. Galvanized surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2, "Hand Tool Cleaning."
   2. SSPC-SP 3, "Power Tool Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPC-PS Guide 7.00, "Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems," to provide a dry film thickness of not less than 1.5 mils.

2.8 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.
   1. Fill vent and drain holes that will be exposed in the finished Work unless they will function as weep holes, by plugging with zinc solder and filing off smooth.
   2. Galvanize lintels, shelf angles and welded door frames attached to structural-steel frame and located in exterior walls.

2.9 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Ultrasonic Inspection: ASTM E 164.
4. Radiographic Inspection: ASTM E 94.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
1. Bend tests will be performed if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel Erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments showing dimensions, locations, angles, and elevations.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC 303 and AISC 360.

B. Base Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.
1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Pretension anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened or Slip critical.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
   1. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

C. Touchup Painting: Cleaning and touchup painting are specified in Section 09911 "Exterior Painting" and Section 09912 "Interior Painting."

END OF SECTION

SECTION 05 3100
STEEL DECKING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Roof deck.

B. Related Requirements:
   1. Section 05 1200 "Structural Steel Framing" for shop- and field-welded shear connectors.
   2. Section 05 5000 "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.
   3. Section 09 9113 "Exterior Painting" for repair painting of primed deck and finish painting of deck.
   4. Section 09 9123 "Interior Painting" for repair painting of primed deck and finish painting of deck.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings:
   1. Include layout and types of deck panels, anchorage details, reinforcing channels, pans, cut deck openings, special jointing, accessories, and attachments to other construction.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Product Certificates: For each type of steel deck.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:
   1. Power-actuated mechanical fasteners.

D. Evaluation Reports: For steel deck.

E. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
   1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 ROOF DECK

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. ASC Profiles, Inc.; a Blue Scope Steel company.
   2. Canam United States; Canam Group Inc.
   3. CMC Joist & Deck.

4. Consolidated Systems, Inc.; Metal Dek Group.
5. Cordeck.
6. DACS, Inc.
7. Epic Metals Corporation.
8. Marlyn Steel Decks, Inc.
9. New Millennium Building Systems, LLC.
10. Nucor Corp.; Vulcraft Group.
11. Roof Deck, Inc.
12. Valley Joist; Subsidiary of EBSCO Industries, Inc.
13. Verco Manufacturing Co.
14. Wheeling Corrugating Company; Div. of Wheeling-Pittsburgh Steel Corporation.

B. Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and with the following:
1. Prime-Painted Steel Sheet: ASTM A 1008/A 1008M, Structural Steel (SS), Grade 33 (230) minimum, shop primed with manufacturer's standard baked-on, rust-inhibitive primer.
a. Color: Manufacturer's standard.
2. Deck Profile: Type WR, wide rib.
3. Profile Depth: 1-1/2 inches.
4. Design Uncoated-Steel Thickness: 0.0358 inch.
5. Span Condition: Triple span or more.
6. Side Laps: Overlapped or interlocking seam at Contractor's option.

2.3 ACCESSORIES

A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
F. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
G. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.
H. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
I. Flat Sump Plates: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck. For drains, cut holes in the field.
J. Repair Paint: Manufacturer's standard rust-inhibitive primer of same color as primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, and requirements in this Section.
B. Install temporary shoring before placing deck panels if required to meet deflection limitations.
C. Locate deck bundles to prevent overloading of supporting members.
D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.
G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.
H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3 ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter that is not less than 1-1/2 inches long, and as follows:
   1. Weld Diameter: 5/8 inch, nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of two welds per deck unit at each support. Space welds as indicated.
   3. Weld Washers: Install weld washers at each weld location.
B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 inches, and as follows:
   1. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
   1. End Joints: Butted.
D. Roof Sump Pans and Sump Plates: Install over openings provided in roof deck and mechanically fasten flanges to top of deck. Space mechanical fasteners not more than 12 inches apart with at least one fastener at each corner.
   1. Install reinforcing channels or zees in ribs to span between supports and mechanically fasten.
E. Miscellaneous Roof-Deck Accessories: Install ridge and valley plates, finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
   1. Weld cover plates at changes in direction of roof-deck panels unless otherwise indicated.
F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
B. Field welds will be subject to inspection.
C. Testing agency will report inspection results promptly and in writing to Contractor and Architect.
D. Remove and replace work that does not comply with specified requirements.
E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.5 PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
B. Repair Painting: Wire brush and clean rust spots, welds, and abraded areas on both surfaces of prime-painted deck immediately after installation, and apply repair paint.
   1. Apply repair paint, of same color as adjacent shop-primed deck, to bottom surfaces of deck exposed to view.
C. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 4000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Load-bearing wall framing.
   2. Exterior non-load-bearing wall framing.
   3. Floor joist framing.
   4. Roof rafter framing.
   5. Ceiling joist framing.
   6. Soffit framing.

B. Related Requirements:
   1. Section 05 5000 "Metal Fabrications" for masonry shelf angles and connections.
   2. Section 09 2116.23 "Gypsum Board Shaft Wall Assemblies" for interior non-load-bearing, metal-stud-framed, shaft-wall assemblies.
   3. Section 09 2216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of cold-formed steel framing product and accessory.

B. Shop Drawings:
   1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
   2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Welding certificates.

C. Product Test Reports: For each listed product, for tests performed by a qualified testing agency.
   1. Steel sheet.
   2. Expansion anchors.
   3. Power-actuated anchors.
   4. Mechanical fasteners.
   5. Vertical deflection clips.
   6. Horizontal drift deflection clips
   7. Miscellaneous structural clips and accessories.

D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

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/D1.3M, "Structural Welding Code - Sheet Steel."

D. Comply with AISI S230 "Standard for Cold-Formed Steel Framing - Prescriptive Method for One and Two Family Dwellings."

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AllSteel & Gypsum Products, Inc.
2. California Expanded Metal Products Company.
3. ClarkWestern Building Systems, Inc.
4. Consolidated Fabricators Corp.; Building Products Division.
5. Craco Mfg., Inc.
6. Custom Stud Inc.
7. Design Shapes in Steel.
8. Dietrich Metal Framing; a Worthington Industries Company.
9. Formetal Co. Inc. (The).
10. MarinoWARE.
11. Nuconsteel; a Nucor Company.
12. Olmar Supply, Inc.
13. Quail Run Building Materials, Inc.
14. SCAFCO Corporation.
15. Southeastern Stud & Components, Inc.
16. State Building Products, Inc.
17. Steel Construction Systems.
18. Steel Network, Inc. (The).
19. Steel Structural Systems.
20. Steeler, Inc.
21. Super Stud Building Products, Inc.
22. Telling Industries, LLC.
23. United Metal Products, Inc.
24. United Steel Manufacturing.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
   a. Exterior Load-Bearing Wall Framing: Horizontal deflection of 1/600 of the wall height.
   b. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/240 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
   c. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
   d. Floor Joist Framing: Vertical deflection of 1/360 for live loads and l/240 for total loads of the span.
   e. Roof Rafter Framing: Vertical deflection of 1/360 of the horizontally projected span for live loads.
   f. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).

4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
   a. Upward and downward movement of 1/2 inch (13 mm).
5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:
1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.3 COLD-FORMED STEEL FRAMING, GENERAL

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than [25] <Insert number> percent.

B. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
1. Grade: As required by structural performance.
2. Coating: Per plan.

C. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
2. Coating: Per plan.

2.4 LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Per plan.
2. Section Properties: Per plan.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm)

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Per plan.
2. Section Properties: Per plan.

D. Steel Single- or Double-L Headers: Manufacturer's standard L-shapes used to form header beams, of web depths indicated, and as follows:
1. Minimum Base-Metal Thickness: Per plan.
2. Section Properties: Per plan.

2.5 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Per plan.
2. Section Properties: Per plan.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips: Manufacturer's standard clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. AllSteel & Gypsum Products, Inc.
   b. ClarkWestern Building Systems, Inc.
   c. Dietrich Metal Framing; a Worthington Industries company.
   d. MarinoWARE.
   e. SCAFCO Corporation.
   f. Steel Network, Inc. (The).
   g. Steeler, Inc.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
   1. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
   2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures and 1 inch (25 mm) plus twice the design gap for other applications.

E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
   1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
      a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
      b. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures and 1 inch (25 mm) plus twice the design gap for other applications.
   2. Inner Track: Of web depth indicated, and as follows:
      a. Minimum Base-Metal Thickness: 0.0538 inch (1.37 mm).
      b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch (25 mm).

F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 FLOOR JOIST FRAMING

A. Steel Joists: Manufacturer's standard C-shaped steel joists, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Per plan.
   2. Flange Width: Per plan.
   3. Section Properties: Per plan.

B. Steel Joist Track: Manufacturer's standard U-shaped steel joist track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Matching steel joists.
   2. Flange Width: 1-1/2 inches (38 mm), minimum.

2.7 ROOF-RAFTER FRAMING

A. Steel Rafters: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Per plan.
   2. Section Properties: Per plan.

2.8 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: Per plan.
   2. Flange Width: Per plan.
   3. Section Properties: Per plan.

2.9 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
   1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).

2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: Per plan.

2.10 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole reinforcing plates.
11. Backer plates.

2.11 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

2.12 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780.

B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.

D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

2.13 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.

B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that are required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

C. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

D. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 LOAD-BEARING WALL INSTALLATION

A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:

1. Anchor Spacing: As indicated.

B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:

1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.

E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.

F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.

1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

I. Install horizontal bridging in stud system, spaced vertically as indicated on shop drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
   1. Stud Spacing: As indicated.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
   1. Install single deep-leg deflection tracks and anchor to building structure.
   2. Install double deep-leg deflection tracks and anchor outer track to building structure.
   3. Connect vertical deflection clips to studs and anchor to building structure.
   4. Connect drift clips to cold-formed metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches (1220 mm) apart. Fasten at each stud intersection.
   1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.

F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
   1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
   2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections as indicated on Shop Drawings.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:
   1. Joist Spacing: As indicated.

D. Frame openings with built-up joist headers consisting of joist and joist track, or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement, or as indicated on Shop Drawings.
   1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection as follows:
   1. Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
   2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.7 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.
C. Testing agency will report test results promptly and in writing to Contractor and Architect.
D. Remove and replace work where test results indicate that it does not comply with specified requirements.
E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.8 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 05 5000
METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Steel framing and supports for overhead doors.
   2. Steel framing and supports for mechanical and electrical equipment.
   3. Steel framing and supports for applications where framing and supports are not specified in other Sections.
   4. Shelf angles.
   5. Miscellaneous steel trim including steel angle corner guards, steel edgings, and loading-dock edge angles.
   6. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section:
   1. Loose steel lintels.
   2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
   3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Sections:
   1. Section 03 3000 "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, slotted-channel inserts, wedge-type inserts and other items cast into concrete.
   2. Section 04 2200 "Concrete Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
   3. Section 05 1200 "Structural Steel Framing."

1.3 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

1.4 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Nonslip aggregates and nonslip-aggregate surface finishes.
   2. Metal nosings and treads.
   3. Paint products.
   4. Grout.

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer.

B. Mill Certificates: Signed by manufacturers of stainless-steel certifying that products furnished comply with requirements.

C. Welding certificates.

D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

1.6 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
   3. AWS D1.6, "Structural Welding Code - Stainless Steel."

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.8 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages and steel weld plates and angles for casting into concrete. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.2 FERROUS METALS

A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40) unless otherwise indicated.

2.3 FASTENERS

A. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.

B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 325, Type 3 (ASTM A 325M, Type 3); with hex nuts, ASTM A 563, Grade C3 (ASTM A 563M, Class 8S3); and, where indicated, flat washers.

C. Anchor Bolts: ASTM F 1554, Grade 36, of dimensions indicated; with nuts, ASTM A 563; and, where indicated, flat washers.
   1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.

D. Eyebolts: ASTM A 489.

E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).

F. Lag Screws: ASME B18.2.1 (ASME B18.2.3.8M).

G. Wood Screws: Flat head, ASME B18.6.1.

H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).

I. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).

J. Anchors, General: Anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

K. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.

L. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
   1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Shop Primers: Provide primers that comply with Section 09911 "Exterior Painting," Section 09912 "Interior Painting," and Section 09960 "High-Performance Coatings."

C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
   1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
E. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
G. Nonshrink, Metallic Grout: Factory-packaged, ferrous-aggregate grout complying with ASTM C 1107, specifically recommended by manufacturer for heavy-duty loading applications.
H. 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.
I. Concrete: Comply with requirements in Section 03300 "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa).

2.5 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. 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. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
D. Form exposed work with accurate angles and surfaces and straight edges.
E. 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.
F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
    1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
B. Fabricate units from 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.
    1. Fabricate units from slotted channel framing where indicated.
    2. Furnish inserts for units installed after concrete is placed.
C. Galvanize miscellaneous framing and supports where indicated.
D. Prime miscellaneous framing and supports with primer specified in Section 09960 "High-Performance Coatings" where indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

1. Provide mitered and welded units at corners.
2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with primer specified in Section 09960 "High-Performance Coatings."

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from 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.

1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

C. Galvanize exterior miscellaneous steel trim.

D. Prime miscellaneous steel trim with primer specified in Section 09960 "High-Performance Coatings."

2.9 LOOSE BEARING AND LEVELING PLATES

A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

B. Galvanize plates.

2.10 LOOSE STEEL LINTELS

A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.

B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches unless otherwise indicated.

C. Galvanize loose steel lintels located in exterior walls.

2.11 STEEL WELD PLATES AND ANGLES

A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.12 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.13 STEEL AND IRON FINISHES

A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.

1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.

B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.

1. Shop prime with primers specified in Section 09911 "Exterior Painting" or primers specified in Section 09912 "Interior Painting" unless primers specified in Section 09960 "High-Performance Coatings" are indicated.

C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:

1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
3. Items Indicated to Receive Primers Specified in Section 09960 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

4. Other Items: SSPC-SP 3, "Power Tool Cleaning."

D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

2.14 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. As-Fabricated Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).

C. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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.

B. 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.

C. 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.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:
1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 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.

B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

C. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

D. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installing Bearing and Leveling Plates" Article.
1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLING 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.

3.4 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded 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.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09911 "Exterior Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION

SECTION 06 1053
MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Miscellaneous rough carpentry and accessories indicated, specified, or required for installation.

1.2 PERFORMANCE REQUIREMENTS

A. Flashings and Roof Coverings:

1. Fabricate and install rough carpentry associated with flashings and roof coverings to withstand wind loads, structural movement, and thermally induced movement without contributing to failure of flashing or roof covering.
2. Comply with recommendations of FM Loss Prevention Data Sheet 1-49 for wind zone classification applicable to project conditions.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of process and factory-fabricated product indicated, specified, or required. Indicate component materials and dimensions and include construction and application details.

1. Preservative Treated Wood: Data from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
2. Waterborne Treated Wood: Data indicating that moisture content of treated materials was reduced to levels specified before shipment to Project.
3. Warranties: Copies from chemical treatment manufacturers for each type of treatment.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Storage: Stack lumber flat with spacers between each bundle to provide air circulation. Provide for air circulation around stacks and under coverings.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Deliver and install doors only when spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS

A. Dimension Lumber:

1. Material Quality Standards:
   a. DOC VPS 20 and applicable rules of grading agencies indicated.
   b. If no grading agency is indicated, provide lumber that complies with applicable rules of any rules-writing agency certified by ALSC Board of Review.
   c. Provide lumber graded by an agency certified by ALSC Board of Review to inspect and grade lumber under rules indicated.
2. Grade Marking:
   a. Factory mark each piece of lumber with grade stamp of grading agency.
   b. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Sizes:
   a. Where nominal sizes are indicated, provide actual sizes required by DOC VPS 20 for moisture content specified.
   b. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
4. Finishing: Provide dressed lumber, sanded four sides, unless otherwise indicated.
5. Grade: No. 2 or better, of any of following species:
   a. Hem-fir (north); NLGA.
   b. Mixed southern pine; SPIB.
   c. Spruce-pine-fir; NLGA.
   d. Hem-fir; WCLIB, or WWPA.

e. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
f. Northern species; NLGA.
g. Eastern softwoods; NeLMA.
h. Western woods; WCLIB or WWPA.

6. Maximum Moisture Content:
   a. 15 percent for 2 in nominal thickness or less.
   b. 19 percent for more than 2 in nominal thickness.

B. Plywood:
1. Material Quality Standard: DOC VPS PS 1, Exposure 1.
2. Grades:
   a. A-C: Exposed at occupied interior locations.
   b. B-C: Exposed at mechanical and electrical equipment rooms.
   c. C-D: Within interior wall assemblies.
   d. Marine:
      1) B-B: Within exterior wall and roof assemblies.
      2) A-B: Exterior exposed to view.
3. Grade Marking: Factory mark each piece of plywood with grade stamp of grading agency
4. Thickness: Not less than 1/2 in, unless indicated otherwise.

2.2 TREATED WOOD MATERIALS

A. Preservative Treated Wood:
1. Product Quality Standard: AWPA, Use Category UC4A, for species, product, preservative, and end use.
2. Description: Wood products impregnated with chemicals, according to following, by pressure process.
   a. Listed in Section 4 of AWPA U1.
   b. That does not promote corrosion of fasteners or metals.
   c. Containing no arsenic or chromium.
   d. Acceptable to authorities having jurisdiction

B. Moisture Content: Kiln-dry wood after treatment to following maximum moisture content:
1. 19 percent for lumber.
2. 15 percent for plywood.

C. Wood with Stained or Natural Finish: Formulations that do not bleed through, contain colorants, or otherwise adversely affect finishes.

D. Quality Marking:
1. Identify with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
2. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. Field Treatment for Cut Surfaces:
1. Continuously Protected from Liquid Water: Inorganic boron.
2. Not Continuously Protected from Liquid Water: Copper naphthenate.

2.3 FASTENERS

A. Fastener Type and Material: Select fasteners for type, grade, and class required. Unless otherwise indicated, Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: ICC-ES NER-272.

D. Powder Actuated Fasteners: ANSI A10.3; low velocity, powder actuated fasteners; drive pins and washers fabricated from corrosion-resistant materials; powder loads suitable for application indicated; and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

E. Wood Screws: ASME B18.6.1, flat head, carbon steel.

F. Lag Bolts: ASME B18.2.1.

G. Bolts: Steel bolts complying with ASTM A 307, Grade A; with ASTM A 563 hex nuts and, where indicated, flat washers.

2.4 ANCHORS

A. Anchors: Capable of sustaining, without failure, a load equal to 6 times load imposed when installed in unit masonry and 4 times load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

B. Cast-in-Place Anchors in Concrete: Bolts, washers, and shims as needed, either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47 malleable iron or ASTM A 27 cast steel; hot-dip galvanized according to ASTM F 2329.

C. Post-Installed Expansion Anchors:

1. Product Quality Standards: ACI 318, D.1 and ICC-ES AC193; approved for cracked concrete conditions when used in concrete that is cracked or may become cracked under connected load.
2. Material and Finish: ASTM F 593, Group 1, Alloy 304 stainless steel.
3. Acceptable Manufacturers and Products:
   a. ITW; Redhead Truebolt Wedge Anchor.
   b. Powers; Bull Wedge Anchor.
   c. Simpson; Strong-Bolt Wedge Anchor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive miscellaneous rough carpentry and associated Work for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. AWPA M4.
2. Approved submittals.
3. Contract Documents.

B. General Requirements:

1. Fasteners:
   a. Select fasteners of appropriate size, type and length that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials.
   b. Make tight connections between members. Install fasteners without splitting wood; do not countersink nail heads, unless otherwise indicated.
   c. Recess bolts and nuts flush with surfaces, unless otherwise indicated.
2. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber.
3. Do not use material with following conditions:
   a. Material that is warped or does not comply with requirements for untreated material.
   b. Materials with defects that interfere with function of member.
   c. Pieces which are too small to use with minimum number of joints or optimum joint arrangement.
4. Set carpentry to required levels and lines, with members plumb, true to line, and level. Fit carpentry to other construction; scribe and cope as needed for accurate fit. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
5. Apply field treatment to cut surfaces of preservative treated wood.

C. Schedule of Applications:

1. Preservative Treated Wood: Cants, nailers, curbs, equipment support bases, blocking,

stripping, and similar members in connection with roof coverings and flashing.

2. Untreated Wood: Interior locations.

3.3 PROTECTION

A. General: Protect untreated wood, and wood that has been treated with chemicals that can leach, from deterioration due to weather.

END OF SECTION

SECTION 06 1643
GYPSUM SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Gypsum sheathing attached to steel framing and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

B. Warranty: Sample of special warranty.

1.3 WARRANTY

A. Manufacturers Extended Special Warranty: Furnish warranty for a period of 5 years from date of substantial completion agreeing to repair or replace defective materials signed by an authorized representative of manufacturer using standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide product by one of the manufacturers listed alphabetically below.

2.2 MATERIALS

A. Gypsum Sheathing:

1. Generic Type: Glass-mat gypsum board.
2. Material Quality Standard: ASTM C 1177.
3. Description: Paperless, treated, water resistant, noncombustible, gypsum core with inorganic glass mat partially or completely embedded on both faces; acrylic coated on one face; 1/2 inch thick. Provide in maximum lengths and widths available that will minimize short-edge-to-short-edge butt joints and to correspond to support system indicated.
4. Acceptable Manufacturers and Products:
   a. CertainTeed Gypsum; GlasRoc Enhanced Glass Reinforced Gypsum Sheathing.
   b. GP Gypsum, A Georgia-Pacific Co.; Dens-Glass Gold Sheathing.
   c. National Gypsum; Gold Bond Brand e^{2}XP Extended Exposure Sheathing.
   d. USG Corporation; Securock Glass-Mat Sheathing Panels.

B. Screw Fasteners:

1. Material Quality Standards:
   a. Metal Framing Members less than 0.030 in Thick: ASTM C 1002, Type S.
   b. Metal Framing Members from 0.033 in to 0.112 in Thick: ASTM C 954, Type S-12.
2. Product Description: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by manufacturer; minimum 1 in long; with corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Conditions:

1. Examine substrate surfaces to which gypsum sheathing will be installed for compliance with requirements, installation tolerances and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with the Contract Documents.
3. Starting Work within a particular area will be construed as acceptance.

3.2 INSTALLATION

A. Installation Quality Standard: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. GA-253.
2. ASTM C 1280.
3. Respective manufacturer's installation instructions.

4. Approved submittals.
5. Contract Documents.

B. Sheathing Installation:
1. Install sheathing with coated face out with edges centered over flanges of steel framing, with edges and ends fit tightly.
2. Avoid installing imperfect, damaged, wet, or damp sheathing.
3. Cut sheathing at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide maximum 3/8 inch setback where sheathing abuts structural elements or materials that may retain moisture.
4. Install screws at perimeter and within field to each steel stud approximately 8 inches on centers; set back minimum 3/8 inch from edges and ends; apply so screw heads bear tightly against sheathing face but do not cut into facing.

END OF SECTION

SECTION 06 4023
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior architectural woodwork and accessories necessary for installation, including, but not limited to, following:
   1. Cabinets, transparent finish wood veneer clad.
   2. Shelving, plastic laminate clad.
   3. Countertops, plastic laminate clad.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required, including but not limited to following:
   1. High-pressure decorative laminate and adhesive for bonding plastic laminate.
   2. Cabinet hardware and accessories.

B. Shop Drawings: Dimensioned and detailed drawings, including plans, elevations, large-scale details, attachment devices, and other components of each woodwork item.
   1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
   2. Show locations and sizes of cutouts and holes.

C. Samples for Verification:
   1. Plastic Laminates: 8 by 10 in, for each type, color, pattern, and surface finish.
   2. Hardware: One full-size unit for each type and finish.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Company with not less than 5 years experience with successful production of specified Work similar to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

B. Fabricator Qualifications:
   1. Experience: Company with not less than 5 years experience in performing specified Work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
   2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

C. Pre-Installation Conference: Before beginning Work of this Section, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
   1. Required Attendees:
      a. Owner.
      b. Architect.
      c. Contractor, including supervisor.
      d. Woodwork Fabricator, including project manager and supervisor.
      e. Woodwork Installer, including project manager and supervisor.
      f. Installers of adjacent Work, including supervisor.
   2. Minimum Agenda: Installer shall demonstrate understanding of Work required by reviewing and discussing procedures for, but not limited to, following:
      a. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory Work performed by other installers.
      b. Review Contract Document requirements.
      c. Review approved submittals.
      d. Review installation procedures.
      e. Review interior environmental conditions and procedures for coping with unfavorable conditions.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

D. Lock and Keying Conference: Before beginning Work of this Section, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
   1. Required Attendees:
      a. Owner.
      b. Architect.
      c. Contractor, including supervisor.
      d. Woodwork Fabricator, including project manager and supervisor.
      e. Woodwork Installer, including project manager and supervisor.
   2. Minimum Agenda: Provide opportunity for Owner to determine following:
      a. If overall cabinet door and drawer locking arrangement will be traditional cam locks or if locks are to be provided for cores specified in appropriate Section 08 7100 - Door Hardware.
      b. Type and function of lock.
      c. Key and keying requirements.
      d. Levels of security required by Owner.
      e. Finishes.
   3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver woodwork only when painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Deliver and install woodwork only when building is enclosed, wet work is complete, and heating, ventilating and air conditioning system is operating and maintaining temperature and relative humidity at occupancy levels during remainder of construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified under items below to establish a standard of quality. Other acceptable manufacturers (where more than one manufacturer is indicated) or available manufacturers (where no other manufacturers are indicated) with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below.

C. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into Work include, but are not limited to, those listed.

2.2 WOOD PRODUCTS

A. General: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Fiberboard (Particleboard is not acceptable):
   1. Material Quality Standard: ANSI A208.2, 47 lb density minimum, Grade 160.
   2. Description: Composite panel composed of cellulosic fibers bonded together with a synthetic resin or other suitable bonding system under heat and pressure.
      a. Moisture resistant type when used for countertops containing sinks.
      b. Fire retardant treated when indicated or required by authorities having jurisdiction.

C. Softwood Plywood (Veneer Core) Material Quality Standard: DOC VPS PS 1, Exposure 1.

D. Hardwood Plywood Material Quality Standard: HPVA HP-1.

E. Lumber: Fabricators option, softwood and hardwood solid wood graded in accordance with

grade of Work specified, of quality suitable for construction and finish indicated.

F. Wood Veneer for Transparent Finish:
   1. Description: Custom sliced hardwood veneer of industry standard thickness necessary for fabrication and finishing woodwork without show-through or sand-through.
   2. Grades: A.
   3. Species: As indicated on Drawings.
   4. Cut: Slip matched.
   5. Matching: Veneer species, cut, and matching of flush wood doors, specified in Section 08 1416 - Flush Wood Doors, shall be the basis for transparent finished woodwork specified by this Section.
   6. Edge Banding: Same wood species as exposed veneer of industry standard thickness.
   7. Grain Direction on Finished Woodwork: Vertical, unless indicated otherwise.

G. Wood Species for Bench at Toilets: As indicated.

2.3 PLASTIC LAMINATES

A. Basis of Design: As specified on Drawings.

B. High-Pressure Decorative Laminates (HPDL):
   1. Product Quality Standard: NEMA LD 3:
      a. Standard Face Sheet: Grade VGS, 0.028 in thick.
      b. High Wear Face Sheet: Grade HDS, 0.048 in thick.
      c. Cabinet Liner Sheet: Grade CLS, 0.020 in thick.
      d. Backing Sheet: Grade BKL, 0.020 in thick.
   2. Available Manufacturers:
      a. Abet Laminati, Inc.
      b. Formica Corp.
      c. International Paper.
      d. Lamin-Art, Inc.
      e. Nevamar Company, LLC; Decorative Products Div.
      f. Pioneer Plastics Corp.
      g. Westinghouse Electric Corp.; Specialty Products Div.
      h. Wilsonart International; Div. of Premark International, Inc.

C. Adhesive for Bonding Decorative Laminates: No-added formaldehyde based thermoplastic resin recommended by fabricator to suit application and comply with specified requirements.

2.4 FASTENERS AND ANCHORS

A. General: Material, type, size, and finish required for each substrate for secure anchorage.

B. Screws: ASME B18.6.1.

C. Nails: FS FF-N-105.

D. Wood Dowels: Industrial grade hardwood laterally fluted with chamfered ends and minimum diameter of 0.31 in.

E. Staples: Not permitted.

F. Glue: Aliphatic resin glue formulated for use on all types of wood; resistant to water, oil, grease, and paint solvents; sandable after drying; complying with VOC limits specified.

G. Biscuits: Die cut from beechwood blanks, and compressed for strength and cross-hatched to improve glue bonding.

H. Hanging Clips: Two piece extruded aluminum zee hanging clips.

I. Countertop Support Brackets:
   1. Description: ASTM B221, 6063-T5 extruded T-shape aluminum profiles formed into L-shaped bracket; mitered and welded joints; pre-drilled holes for mounting; 5/8 in diameter holes with rubber grommets; edges and welds grinded and deburred.
   2. Factory Finish: Electrostatically applied powder paint coating complying with AAMA 605.2; color as selected from manufacturer's standard colors.
   3. Available Manufacturer and Products:
      a. For 24 in Countertops: Rangine Corp.; Rakks EH 1818 for up to 450 lbs for each bracket.
      b. For 30 in Countertops: Rangine Corp.; Rakks EH 1824 for up to 450 lbs for each bracket.

J. Acrylic Caulking:
1. Description: Siliconized acrylic caulking custom colored to match adjacent finished surfaces.
2. Available Manufacturers and Products:
a. ColorFast Industries Inc.; Laminate Caulk.
b. ColorRite; ColorRite.
c. Kampel Enterprises, Inc.; ColorFlex Custom Colored Caulking.

2.5 CABINET HARDWARE AND ACCESSORIES

A. Cabinet Door Hinges:
1. Product Quality Standard: BHMA A156.9, Grade 1.
2. Description: Frameless concealed hinges (European hinges), full overlay, minimum 165 degree swing, self-closing, allows door to be removed without tools, and allows adjustment of side, depth, height, and spring force.
3. Finish and Material: Nickel plated steel.
4. Number of Hinges:
a. 2 Hinges: Doors 24 in wide to 36 in high and 9 to 11 lbs.
b. 3 Hinges: Doors 24 in wide to 60 in high and 13 to 20 lbs.
c. 4 Hinges: Doors 24 in wide to 80 in high and 29 to 33 lbs.
d. 5 Hinges: Doors 24 in wide to 96 in high and 40 to 48 lbs.
5. Available Manufacturers:
a. Blum Inc.
b. Ferrari America.
c. Grass America, Inc.
d. Hafele America Co.
e. Hettich America.
f. Melpha-Alfit USA.
g. Salice America.

B. Door and Drawer Pulls:
1. Description: Wire design, 5/16 in outside diameter, 1-5/16 in projection, 4 in center to center; back mounted.
2. Finish and Material: Satin stainless steel.
3. Basis of Design: EPCO (Engineered Products Co.); MC402-4-SS.

C. Magnetic Catches:
1. Product Quality Standards: BHMA A156.9 and B03141.
2. Basis of Design: Stanley; 46.

D. Elbow Catch Basis of Design: Ives; 2 Elbow Catch.

E. Clothes Hanging Rod:
1. Description: 1-1/14 inch aluminum tubing with brackets appropriated for the conditions:
2. Basis of Design:
a. Manufacturer: EPCO (Engineered Products Co.).
b. Rod: 890-8-DC
c. Cuff Flanges: 855-DC.
d. Center Support: 853-DC.

F. Shelf Rests:
1. Description: Stamped steel with pin size and finish indicated.
2. Basis of Design: EPCO (Engineered Products Co.); 522-N (5 mm pin) or 520-N (1/4 inch pin), nickel finish.

G. Drawer Slides:
1. Product Quality Standard: BHMA A156.9, B05091, Grade as indicated.
2. Description: Side or rail mounted, travel as indicated, progressive movement, zinc-plated steel slides with all steel ball bearings; and as indicated below.
3. Box Drawer Slides:
a. Product Quality Standard: Grade 1, HD-100, 100 lbf load rating.
b. Description: Full extension type for width indicated below and height 6 in and less.
c. Basis of Design:

1) 24 in Wide and Less: Accuride; 7434.
2) Wider than 24 in: Accuride; 7432.

4. File Drawer Slides:
   a. Product Quality Standard: Grade 1HD-200, 200 lbf load rating.
   b. Description: Full extension type for width of 42 in and less with 1 in over travel.
   c. Basis of Design: Accuride; 3640.
5. Pencil Drawer Slides:
   a. Product Quality Standard: Grade 1, 50 lbf load rating.
   b. Description: Full extension type for width of 16 in and less and height 3 in and less.
   c. Basis of Design: Accuride; 2632.
6. Computer Keyboard Slides:
   a. Description: Adjustable height, 75 lb load rating. 3/4 extension.
   b. Basis of Design: K & V; 8157.

H. Door and Drawer Locks:
1. Products: Provide locks, keys and accessories determined at lock and keying conference.
2. Available Manufacturers:
   a. Illinois Lock Co.
   b. Kenstan Lock Co.
   c. C. R. Laurence Co., Inc.
   d. Olympus Lock
   e. Phoenix Lock Co.

I. Grommets Basis of Design: Doug Mockett & Co., Inc.; MM Series solid brass, 3 in overall diameter; MM5 caps with MM5A liners; BHMA 626 finish.

2.6 FABRICATION, GENERAL

A. Fabrication Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified:
1. AWI/AWMAC/WI - Architectural Woodwork Standards, Sections as indicated below.
2. Approved submittals.
3. Contract Documents.

B. Shop Fabrication: Fabricate, assemble, finish, and install hardware to maximum extent possible before shipment to site.
1. Fabricate woodwork to dimensions, profiles, and details indicated.
2. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
3. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.
4. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

C. Wood Moisture Content: Comply with requirements of quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

D. Furring, Blocking, Shims, and Hanging Strips: Fabricate from fire retardant treated lumber; sand lightly to remove raised grain on exposed surfaces before fabrication.

2.7 CABINETS

A. Fabrication Quality Standard: AWI/AWMAC/WI - Architectural Woodwork Standards, Section 10:
1. Grade: Premium.
2. Construction Type: A.
3. Interface Style: 1, flush overlay.

B. Finish for Cabinets with Shop Applied Transparent Finish:
   1. Exposed Surfaces: Shop applied transparent finish, selection as scheduled.
   2. Semi-Exposed Surfaces: As indicated:
      a. Shop applied transparent finish, selection as scheduled.
      b. HPDL cabinet liner sheet, selection as scheduled.
   3. Concealed Surfaces: HPDL backing sheet.

C. Finish for Cabinets with Plastic Laminate Cladding:
   1. Exposed Surfaces: HPDL standard face sheet, selection as scheduled.
   2. Semi-Exposed Surfaces: HPDL cabinet liner sheet, selection as scheduled.
   3. Concealed Surfaces: HPDL backing sheet.

D. Body Members (Ends, Divisions, Bottoms and Sub-Tops): Fiberboard, 3/4 in minimum thickness.

E. Face Frames, Rails, Kicks and Bases: Hardwood lumber or hardwood plywood, 3/4 in minimum thickness; do not use hardwood plywood if hinge screws enter edge of rail only.

F. Shelves: Hardwood plywood supported on shelf rests set in 2 vertical rows of multiple holes:
   1. Spans up to 32 in: 3/4 in minimum thickness.
   2. Spans up to 42 in: 1 in minimum thickness.

G. Drawer Boxes:
   1. Sides, Backs and Sub-Fronts: Depending on scheduled finish, 7 ply hardwood lumber or hardwood plywood; 1/2 in minimum thickness; joined according to one of following:
      a. Glued multiple dovetail.
      b. Glued French dovetail.
      c. Glued and doweled.
   2. Bottoms: Depending on scheduled finish, hardwood plywood; 1/4 in minimum thickness; captured in standing dado shoulder.

H. Drawer Fronts: Fiberboard, 3/4 in minimum thickness.

I. Doors: Fiberboard; if hinge screws enter only edge of door, provide 3/4 in lumber edges glued to core prior to laminating:
   1. Width up to 30 in and Height up to 60 in: 3/4 in minimum thickness.
   2. Width up to 36 in and Height up to 72 in: 1 in to 1-1/4 in thickness.
   3. Doors Larger Than Sizes Above: 1-3/8 in or 1-3/4 in doors; refer to appropriate Section 08 1416 - Flush Wood Doors.

2.8 PLASTIC LAMINATE CLAD COUNTERTOPS

A. Fabrication Quality Standard: AWI/AWMAC/WI - Architectural Woodwork Standards, Section 11: Premium grade.

B. Finish for Countertops and Splashes with Plastic Laminate Cladding:
   1. Exposed Surfaces: HPDL high wear face sheet, selection as scheduled.
   2. Exposed Splash Surfaces: HPDL standard face sheet, selection as scheduled.
   3. Countertop Edges: Stained wood bullnose.
   4. Splash Edges: HPDL standard face sheet, selection as scheduled.
   5. Concealed Surfaces: HPDL backing sheet.

C. Core Material: Fiberboard, moisture resistant type at countertops containing sinks:
   1. Countertops: 3/4 in minimum thickness.
   2. Splashes: 1/2 in minimum thickness.

D. Fabrication Provisions: Fabricate to eliminate or minimize need for joints that are assembled in field.

2.9 SHELVING

A. Fabrication Quality Standard: AWI/AWMAC/WI - Architectural Woodwork Standards, Section 10, Premium grade.

B. Shelf and Cleat Material: As allowed by fabrication quality standard for finish.

C. Location of Shelf Support: As required to limit deflection of shelf to 1/4 in according to referenced quality standard.

2.10 SHOP APPLIED TRANSPARENT FINISH

A. Finish Quality Standard: AWI/AWMAC/WI - Architectural Woodwork Standards, System 5 - conversion varnish.

B. Grade: Premium.
C. Stain: To be determined.
D. Sheen: Satin, 31-45 gloss units.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which interior architectural woodwork will be installed for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Conditioning: Before installation, condition woodwork to average prevailing temperature and humidity conditions in installation areas.

3.3 INSTALLATION. GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. AWI/AWMAC/WI - Architectural Woodwork Standards.
2. Approved submittals.
3. Contract Documents.
B. Grade: Install to comply with requirements for same fabrication grade specified for type of involved.
C. Exposed Lines: Set individual items as follows with no distortions:
1. Horizontal Lines: Level and straight.
2. Vertical Lines: Plumb and true.
D. Fitting:
1. Scribe and cut to fit adjoining work and refinish cut surfaces.
2. Shim as required for conditions with concealed shims.
3. When necessary, apply filler strips for accurate fit with fasteners concealed
E. Attaching to Substrates:
1. Fasten to partition framing or concealed reinforcements.
2. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.
3. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish.
4. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
F. Treating Nail Holes and Wood-to-Wood Joints: Fill with matching wood filler, sand smooth, and finish same as adjacent finishes.

3.4 INSTALLING CABINETS

A. Installation Provisions, General:
1. Install accurately aligned and without distortion so doors and drawers fit openings properly.
2. Make flush, tight, and uniform joints
3. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
4. Install acrylic caulking at open joints.
B. Installing Base Cabinets:
1. Fasten securely through back to partition framing or concealed reinforcements with fasteners spaced not more than 24 in on center; bolt adjacent cabinets together.
2. Where not installed adjacent to partitions, fasten securely to floor at toe space with fasteners spaced not more than 24 in on center. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than 2 fasteners.
C. Installing Wall Cabinets: Fasten securely through back to partition framing or concealed

reinforcements with fasteners spaced not more than 16 in on centers.

D. Tolerance for Sag, Bow, or Other Variation from Straight Line: Not more than 1/8 in in 96 in.

3.5 INSTALLING COUNTERTOPS

A. Installing Plastic Laminate Clad Countertops:
   1. Fasten securely with screws through corner blocks of base cabinets or other supports into underside of countertop.
   2. Prepared in shop so site processing of top and edge surfaces is not required.
   3. Abut top and edge surfaces in one true plane with internal supports placed to prevent deflection.
   4. Secure joints with concealed joint connectors located within 6 in of front and back edges and at intervals not exceeding 24 in on center. Tighten to exert a constant, heavy-clamping pressure at joints.
   5. Install acrylic caulking at open joints.

B. Installing Plastic Laminate Clad Backsplashes:
   1. Secure to walls with adhesive.
   2. Install acrylic caulking at following joints:
      a. Between countertop and splashes.
      b. Between countertop and surrounding substrates.
      c. Between splashes and surrounding substrates.

C. Tolerance for Sag, Bow, or Other Variation from Straight Line: Not more than 1/8 in in 96 in.

3.6 INSTALLING SHELVING

A. Installation Provisions, General:
   1. Use full-length pieces to greatest extent possible. Do not use pieces less than 36 in long, except where shorter single-length pieces are necessary.
   2. Scarf and stagger running joints in adjacent and related members.
   3. Install acrylic caulking at open joints.

B. Tolerance for Variation from Straight Line: Not more than 1/8 in in 96 in.

END OF SECTION

SECTION 06 6116
SOLID SURFACING FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Solid surface material fabricated into shower enclosures, countertops, and splashes and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's written installation instructions.

B. Shop Drawings: Dimensioned and detailed plans, elevations, large-scale details, attachment devices, and other components to be incorporated into Work.
   1. Show materials, finishes, edge and splash profiles, and methods of joining.
   2. Show locations and sizes of cutouts and holes for plumbing fixtures, accessories and other items installed in countertops.

C. Samples for Verification: Sample indicating color and pattern of each fabrication specified.

D. Maintenance Data: For inclusion in maintenance manual required by Division 01.
   1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
   2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications: Company with not less than 5 years experience with successful production of specified Work similar to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications: Company with not less than 5 years experience in performing specified Work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Obtain and comply with manufacturer's recommendations for optimum temperature and humidity conditions for storage and installation. Store and install only after these conditions have been attained and stabilized from date of installation through remainder of construction period.

1.5 WARRANTY

A. Manufacturers Special Warranty: Furnish full replacement including products and installation warranty for a period of 10 years from date of substantial completion agreeing to repair or replace solid surfacing fabrication defects, faulty Work and failures, signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Basis of Design, General: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change concept expressed in Contract Documents as judged by Architect.

B. Basis of Design for Countertops: As indicated on Drawings.

C. Basis of Design for Shower Enclosures:
   1. Manufacturer: The Swan Corporation.
   2. Shower Enclosure:
      a. Product: SS-(size to fit floor)-1 (3 per panels for each shower unit).
      b. Size: Width to fit floor by 96 in high.
      c. Thickness: Not less than 1/4 in.
      d. Front Edge: Straight, slightly eased at top.
      e. Trim Kit: TK105.

f. Adhesive: SS72.

3. Floor:
   a. Barrier Free Location - Room 147:
      1) Product: SBF-3464.
      2) Size: 34 in by 64 in.
   b. Other Locations:
      1) Product: SS-3448.
      2) Size: 34 in by 48 in.
4. Accessories Shelf: RS-2215.
5. Color: As indicated on Drawings.

2.2 MATERIALS

A. Solid Surfacing Material:
   1. Material Quality Standard: ANSI/IPCA SS-1.
   2. Description: Homogenous, compression molded material composed of acrylic resins or polyester/acrylic resin blend, fire-retardant filler materials, fiber reinforcement, and coloring agents meeting following requirements:
      a. Surface Burning Characteristics: According to ASTM E 84:
         1) Flame Spread: 15.
         2) Smoke Developed Index: 255.
      b. Liquid Absorption: 0.033 percent for 1/4 inch material thickness according to ASTM D 570.
      c. Izod Impact: 6.6 foot pounds per inch according to ASTM D 256, Method A.
      d. Tensile Modulus: Nominal 1.48 X 10^6 pounds per square inch according to ASTM D 638.
      e. Hardness, Barcol Impressor: 42 according to ASTM D 785.
      f. Flexural Modulus: 1.22 X 10^6 pounds per square inch according to ASTM D 638.
      g. Stain Resistance: Passes according to ANSI-Z 124.3.
      h. Boiling Water Resistance: No effect according to NEMA LD 3, Method 3.5.
      i. Ball Impact Resistance: Over 150", no damage according to NEMA LD 3, Method 3.8, one pound ball, unsupported.
      j. Bacterial Resistance: Passes according to ASTM G 22.
      k. Abrasion Resistance: Passes according to ANSI-Z124.3.

B. Solid Surfacing Accessory Shelf: ANSI Z 124.3, compression molded items of same homogenous material, composed of mineral-filled thermoplastic polymers with fiber reinforcement finished to smooth surface.

2.3 ACCESSORIES

A. Adhesives: No-added formaldehyde based, 1 or 2 part, adhesive capable of creating inconspicuous, non-porous seams; provided by material manufacturer.

B. Sealant: Mildew resistant, FDA compliant, NSF 51 compliant, UL listed silicone sealant in color that matches material; provided by material manufacturer.

2.4 FABRICATION

A. Fabricate in large pieces at shop before shipment to Project to maximum extent possible.

B. Disassemble components only as necessary for shipment and installation.

C. Where necessary for fitting at Project, provide ample allowance for scribing, trimming, and fitting.

D. Accurately cut holes and drill countertop panels to receive plumbing, fixtures, and other accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive solid surfacing fabrications and associated Work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting Work within a particular area will be construed as acceptance of surface

conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified:
   1. Respective manufacturer's written instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Anchorage:
   1. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer.
   2. Secure backsplashes to tops and walls with adhesive.

C. Seams:
   1. Prepare ends and edges of pieces to be joined according to manufacturer's instructions for position and angle of butted joint.
   2. Clean to remove dirt and grease.
   3. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's instructions.
   4. Clamp until fully cured.
   5. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
   6. Buff and sand to produce a smooth uniform seamless surface.

D. Joints to Other Substrates: Apply sealant and compress to form bond with surfaces and tool sealant surface to clean, straight lines.

E. Installation Tolerances: Install plumb, level, accurately aligned, and located to a tolerance of 1/8 in in 8 ft.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 07 2100
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Thermal insulation and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of insulation product indicated, specified, or required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed alphabetically below.

2.2 MATERIALS, GENERAL

A. General: Provide insulating materials that comply with requirements and referenced standards in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.

2.3 INSULATION MATERIALS

A. Fiberglass Batt Insulation:
   1. Product Quality Standard: ASTM C 665, Type I.
   2. Description: Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder; free of formaldehyde.
   3. Surface Burning Characteristics:
      a. Flame Spread: Class A, no greater than 25.
      b. Smoke Developed: No greater than 50.
   4. Combustion Characteristics: Pass.
   5. R-Value: R-19.
   6. Basis of Design:
      a. Manufacturer: Johns Manville.
      b. Product: Unfaced Batts for Metal Framing, Formaldehyde Free.
   7. Available Manufacturers and Products:
      a. CertainTeed Corp.; CertaPro.
      b. Guardian Fiberglass, Inc.; Unfaced Batts for Metal Framing.
      c. Johns Manville; Unfaced Batts for Metal Framing.
      d. Owens-Corning; Thermal Batts for Metal Frame Construction.

B. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

2.4 INSULATION FASTENERS

A. Spindle Anchors:
   1. Description: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place.
   2. Plate: Perforated galvanized carbon-steel sheet, 0.030 in thick by 2 in square.
   3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 in in diameter; length to suit depth of insulation indicated.
   4. Basis of Design:
      a. Manufacturer: AGM Industries, Inc.
      b. Product: TACTOO Insul-Hangers.

B. Retaining Washers:
   1. Description: Self locking washers formed from 0.016 in thick galvanized steel sheet, with

beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 in square or in diameter. Where spindles will be exposed to human contact after installation, protect ends with capped self locking washers incorporating a spring steel insert to ensure permanent retention of cap.

2. Basis of Design:
   a. Manufacturer: AGM Industries, Inc.
   b. Product: RC150 or SC150.

C. Spacing Clip:
1. Description: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 in between face of insulation and substrate to which anchor is attached.
2. Basis of Design:
   a. Manufacturer: AGM Industries, Inc.
   b. Product: Metal Spacing Clips.

D. Anchor Adhesive:
1. Description: Product with demonstrated capability to bond insulation anchors securely to substrates indicated without damaging insulation, fasteners, and substrates.
2. Basis of Design:
   a. Manufacturer: AGM Industries, Inc.
   b. Product: TACTOO GPA-72 General Purpose Adhesive.

E. Available Manufacturers:
1. AGM Industries, Inc.
2. Gemco.

2.5 ACCESSORIES

A. Adhesive for Bonding Insulation: Product compatible with insulation being bonded and with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation or substrates.

B. Sprayed Foam Gap Sealant:
1. Description: Low pressure, one component, expanding, closed-cell polyurethane foam applied with professional hand-held dispensing gun; CFC and HCFC free.
2. Available Manufacturers and Products:
   a. Convenience Products; Touch ‘n Seal.
   b. Dow Chemical Co.; Great Stuff Pro.
   c. Fomo Products, Inc.; Handi-Foam.
   d. RHH Foam Systems, Inc.; Versi-Tite.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which thermal insulation will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

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

B. Sealing Gaps at Exterior Walls: Prior to installation of insulation, apply sprayed foam gap sealant to gaps, cracks, cavities, openings, and voids in exterior wall back-up, including annular space around piping; prevent sprayed foam gap sealant from being exposed to exterior to eliminate air drafts.

3.3 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:

1. Respective manufacturer's installation instructions.
2. Approved submittals.
3. Contract Documents.

B. General Requirements:
1. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.
2. 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.

C. Fiberglass Batt Insulation at Wall Cavities:
1. Use insulation widths and lengths that fill the cavities formed by framing members. Where more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Where partition will be covered by gypsum board on only one side, apply adhesive to backside of gypsum board that is installed and press insulation in place to form bond to prevent insulation from sagging within cavity.

D. Fiberglass Batt Insulation at Underside of Roof Deck:
1. Adhere spindle anchors to substrate with adhesive at a spacing of not more than 16 inches on centers each way; allow adhesive to dry.
2. Apply spacing clips to each spindle anchor to create space between insulation and underside of roof deck.
3. Press batt insulation into position over spindles and secure tightly with retaining washers, taking care not to compress insulation below specified thickness.

3.4 PROTECTION

A. Protection:
1. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
2. 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

THIS PAGE INTENTIONALLY BLANK

SECTION 07 2423
DIRECT APPLIED FINISH SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Direct applied finish system (DEFS) and accessories indicated, specified, or required to complete application.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required; include following:
   1. Manufacturer's catalog number and general classification for each product.
   2. Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Samples for Verification: 12 inch square sample prepared on rigid backing for each type of factory-prepared finish coat indicated.

1.3 QUALITY ASSURANCE

A. Manufacturers Qualifications: Manufacturer with 10 years continuous documented experience in design and manufacture of cement stucco of type and scope required for project.

B. Applicator Qualifications:
   1. Experience: Company experienced with not less than 5 years experience in performing specified work similar in design, products, and extent to scope of this Project; with:
      a. A record of successful in-service performance.
      b. Sufficient production capability, facilities, and trained and skilled personnel.
   2. Supervision: Maintain a competent supervisor who is at Project during times specified work is in progress, and, who is experienced in installing work similar in design, products, and extent to scope of this Project.

C. Field Samples: Before beginning work of this Section, make as many field samples as required to verify selections made under submittals. Approval does not constitute approval of deviations from Contract Documents, unless such deviations are specifically approved by Architect in writing.
   1. Build field samples approximately 48 inches in length on soffit.
   2. Locate facing south.
   3. Use same workers, including supervisors, which will perform work on Project.
   4. Install products and materials according to specified requirements.
   5. Work on field samples shall be representative of those to be expected for work.
   6. Finish various components to show maximum variation that will exist in work.
   7. Obtain Architect's approval before starting work.
   8. Maintain field samples during construction in an undisturbed condition as a standard for judging completed Work.

1.4 DELIVERY AND STORAGE

A. Delivery: Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Storage: Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature recommended by manufacturer. Maintain storage containers in a clean condition, free of foreign materials and residue.

1.5 PROJECT CONDITIONS

A. Temperature: Apply only when temperatures of surfaces to be coated and surrounding air are between minimum and maximum range recommended by manufacturer.

B. Ambient Conditions: Do not apply under following conditions:
   1. During snow, rain, fog, or mist.
   2. When relative humidity exceeds 85 percent.
   3. At temperatures less than 5 degrees F above the dew point.
   4. To damp or wet surfaces.

1.6 WARRANTY

A. Manufacturers Special Warranty: Furnish repair and replacement warranty for 5 years from date

of substantial completion agreeing to repair or replace direct applied finish system with following defects and deficiencies, signed by an authorized representative using manufacturer's standard form.

1. Cracks.
2. Bonding failures.
3. Finish degradation.
4. Loss of color.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
   1. Manufacturer: Sto Corp.
   2. System: Sto Quik Gold.

2.2 TRIM ACCESSORIES

A. J-Beads:
   1. Product Description: Square edge trim for encasing edge of gypsum board.
   2. Material Quality Standard: ASTM A 653, G60, hot-dip galvanized zinc coating.
   3. Basis of Design: USG Corp.; J-Trim, 200-A.

B. Control Joints:
   1. Product Description: One-piece trim formed with V-shaped slot, with removable strip covering slot opening.
   2. Material Quality Standard: ASTM B A 653, G60, hot-dip galvanized zinc coating.
   3. Basis of Design: USG Corp.; Control Joint, 093.

C. Screw Fasteners:
   1. Product Quality Standard: ASTM C 1063.
   2. Description: Self-drilling and self-tapping screws with pan or wafer type head; fabricated from corrosive resistant or nonferrous metal; in lengths required to achieve minimum penetration of 3/8 inch beyond stud.

2.3 COMPONENTS

A. Gypsum Sheathing: Glass-mat gypsum board specified in Division 06 Section "Gypsum Sheathing."

B. Base Coat:
   1. Description: Factory-mixed, single component, polymer-modified, cementitious, high-build base coat with not more than 33 percent portland cement content by weight.
   2. Basis of Design: Sto; Sto BTS Plus.

C. Reinforcing Mesh: Nominal 4.5 ounce per square yard, symmetrical, interlaced open-weave glass fiber fabric with alkaline resistant coating.

D. Primer:
   1. Description: Factory-mixed, 100 percent acrylic polymer suitable for preparing base coat to receive finishes, tinted same color as finish coat.
   2. Basis of Design: Sto; Sto Primer Sand.

E. Finish Coat:
   1. Description: Factory-mixed, elastomeric, silicone-emulsion that is weatherproof, resistant to dirt pickup, resistant mildew, and bridges hairline cracks.
   2. Basis of Design: Sto; StoSilco Lastic.
   3. Color: As selected from manufacturer's standard colors.

F. Water: Clean, fresh, potable water, free of mineral or organic matter which can affect based coat, field added.

2.4 MIXING

A. General: Mix according to manufacturer's written instructions.

B. Base Coat:
   1. Clean mixer or mixing boxes of set or hardened materials before materials for a new batch are loaded.

2. Mix each batch separately.
3. Mix materials dry to uniform color and consistency before adding water, then mix with water.
4. Mix only as much as can be used prior to initial set.
5. Do not retemper or use partially set mixes.
6. Do not use frozen, caked or lumpy materials.
7. Protect mixtures from frost, contamination, and evaporation.

C. Finish Coat:
1. Mix until a uniform workable consistency is attained.
2. A small amount of water may be added to adjust workability.
3. Use no additives such as rapid binders, antifreeze, or accelerators.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which direct applied finish system (DEFS) will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 APPLICATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
1. Respective manufacturer's installation instructions.
2. Approved submittals.
3. Contract Documents.

3.3 PREPARATION

A. Treating Gypsum Sheathing Joints: Tape joints with a 6 inch wide strip of reinforcing mesh centered over joint and embedded in base coat.

3.4 APPLICATION

A. Installing Accessories:
1. Attach accessories through sheathing with screw fasteners to hold in place and alignment; secure at ends and not more than 12 inches on centers.
2. Maintain 1/4 inch between accessory and abutment to form a sealant joint.
3. Install longest lengths possible, avoid butt joints.
4. Install so that finish will be true to line, level, plumb, square, curved or as otherwise required, without excessive thickness of materials.
5. Miter or cope at corners; install with tight joints seated with sealant and in alignment.

B. Applying Base Coat:
1. Apply over sheathing to uniform thickness of approximately 1/16 inch, or as indicated by manufacturer instructions.
2. Immediately embed reinforcing mesh into wet base coat by troweling from center to edge of mesh; avoid wrinkles in mesh. Avoid wrinkles in mesh.
3. Overlap mesh not less than 2-1/2 inches at mesh joints and stagger mesh overlaps minimum 8 inches from sheathing joints. Overlap mesh from sheathing onto perforated accessory flange.
4. Fully embed mesh so that no mesh color shows through base coat when it is dry. Feather mesh overlaps to avoid reading mesh through finish coat.
5. Allow to dry before applying primer.

C. Applying Primer:
1. Apply primer over base coat with brush, roller, or proper spray equipment in a continuous coat.
2. Allow to dry before applying finish coat.

D. Applying Finish Coat:
1. Apply to primed base coat when dry.

2. Apply by spraying or troweling with a stainless steel trowel, depending on the finish specified.
3. Apply finish coat in a continuous application, always working to a wet edge, and work to finish that matches approved submittals.
4. Avoid application in direct sunlight.
5. Apply in a continuous application, and work a wet edge towards the unfinished wall area. Work to an architectural break in the soffit before stopping to avoid cold joints.
6. Do not install separate batches of finish side-by-side.
7. Do not apply finish into or over joints or accessories.
8. Do not apply finish over irregular or unprepared surfaces, or surfaces.

3.5 ADJUSTING

A. Imperfections: Repair or replace work to eliminate cracks, dents, blisters, buckles, crazing, check cracking, dry outs, efflorescence, sweat outs, excessive pinholes, and similar imperfections and where bond to substrate has failed.

END OF SECTION

SECTION 07 2617
BELOW SLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Below slab vapor retarder and accessories necessary items to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical product literature for each product indicated, specified, or required.
   1. Include manufacturer's installation instructions.
   2. Include manufacturer's standard drawing details for lapping, openings, penetrations, corners, and other conditions encountered.

1.3 QUALITY ASSURANCE

A. Pre-Installation Conference: Before reinforcing Work for concrete slabs begins, conduct conference at Project to comply with requirements of applicable Division 01 Sections.
   1. Required Attendees:
      a. Owner.
      b. Architect.
      c. Structural engineer.
      d. Contractor, including supervisor.
      e. Vapor retarder installer, including supervisor.
      f. Concrete installer, including supervisor.
      g. Installers of adjacent Work, including supervisor.
      h. Owner's testing agency.
      i. Manufacturer's technical representative.
   2. Minimum Agenda: Installer shall demonstrate understanding of work required by reviewing and discussing procedures including, but not limited to, following:
      a. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, sequence of installation, and other preparatory work performed by other installers.
      b. Review Contract Documents requirements.
      c. Review approved submittals.
      d. Review required inspections, testing, certifying, and material usage accounting procedures.
      e. Review installation procedures, including but not limited to:
         1) Sequence of installation.
         2) Evaluation of earth subgrade and preparation of surface.
         3) Placement and lapping of sheets.
         4) Treatment at openings, penetrations, and corners.
         5) Repairs to damaged products.
         6) Other conditions encountered.
      f. Review precautions and procedures for working over vapor retarder.
      g. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
   3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
   1. Manufacturer: Stego Industries LLC.
   2. Vapor Retarder Sheet: Stego Wrap 15 mil Vapor Barrier.

2.2 MATERIALS

A. Vapor Retarder Sheet:
   1. Product Quality Standard: ASTM E 1745, Class A, except water vapor permeance property shall not exceed 0.01 perm according to ASTM E 96, Method B, after condition testing according to ASTM E 154, Sections 8, 11 ,12, and 13.
   2. Description: Prefabricated, flexible, lightweight material manufactured from raw or virgin polyethylene or polyolefin resins (post-consumer, recycled resins are not permitted); not less than 15 mils thick.

2.3 ACCESSORIES

A. Seaming Tape: Manufacturers standard one-sided or two-sided pressure-sensitive tape of type, material and size for sealing membrane joints and for sealing membrane to other adjacent structures; water permeance property shall not exceed 0.03 perm according to ASTM F 1249 or ASTM E 96; provided by vapor retarder manufacturer.

B. Mastic:
   1. Product Quality Standard: ASTM D 412.
   2. Description: Manufacturers standard water-based bituminous asphalt emulsion; water permeance property shall not exceed 0.03 perm according to ASTM F 1249 or ASTM E 96; provided by vapor retarder manufacturer

C. Penetration Accessories: Manufacturers standard premolded products or mastic for sealing penetrations; provided by vapor retarder manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine subgrade and foundation surfaces to receive below slab vapor retarder for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Subgrade: Ensure subgrade is smooth, level, and compacted without sharp or protruding objects that might rip, tear or puncture membrane.

3.3 INSTALLATION

A. Installation Performance Requirements: Ensure vapor retarder isolates earth subgrade from concrete slab.

B. Installation Quality Standards: In additions to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. ASTM E 1643, except place vapor retarder on top of granular fill.
   2. Respective manufacturer's installation instructions.
   3. Approved submittals.
   4. Contract Documents.

C. Installation: Install multiple vapor retarder sheets to form continuously sealed below slab vapor retarder over properly prepared earth subgrade prior to slab reinforcement installation.
   1. Place retarder in widest width possible over subgrade with longest dimension parallel with direction of concrete pour with proper face toward concrete; pull taut to eliminate fishmouths, wrinkles, buckles, and kinks.
   2. Properly dry and clean mating surfaces of sheet prior to sealing with seaming tape.
   3. Overlap sides and ends of retarder not less than 6 in and seal with seaming tape.
   4. Ensure retarder is continuous from edge to edge of concrete slabs according to following:
      a. Place on top of footings and "roll-up" onto vertical surfaces and seal with seaming tape.
      b. Extend out from under edges of concrete slabs 2 in minimum to demonstrate continuity.
   5. Cut sheet carefully around penetrations and seal with either premolded accessories, or on-site collar fabrications using seaming tape or mastic; if field fabricated comply with

manufacturers recommended details.

6. Repair rips, tears, or punctures with seaming tape, or by cutting out damaged areas and patching with new sheet, overlapping damaged area 6 in minimum in each direction and sealing with seaming tape.

3.4 FIELD QUALITY CONTROL

A. Manufacturers Field Service: Manufacturers qualified technical representative, not a sales representative, shall inspect first days work and periodically inspect work of this Section to ensure installation is proceeding in accordance with manufacturer's designs, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings and conclusions of inspection.

3.5 PROTECTION

A. Protection During Concrete Work: Ensure vapor retarder will be without damage or deterioration during in-place fabrication of steel reinforcement and subsequent placement of concrete.

1. Prevent vehicles from driving over vapor retarder once it has been placed.
2. Prevent wood or steel stakes from penetrating vapor retarder.
3. At locations where portions of slab are not placed (block-outs, voids and leave-outs), provide protection to prevent water infiltration into void that would contaminate subgrade below vapor retarder; maintain until concrete is subsequently placed.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 07 2726
FLUID-APPLIED MEMBRANE AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fluid-applied, vapor permeable membrane air barrier assembly, and accessories indicated, specified, or required to complete application.

1.2 DEFINITIONS

A. Air Barrier Assembly: Collection of air barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required; include following:
   1. Manufacturer's written application instructions.
   2. Manufacturer's written instructions for evaluating, preparing, and treating substrate onto which work will be applied.
   3. Manufacturer's written approval of products not manufactured by primary manufacturer.
   4. Manufacturer's written statement that materials are compatible with adjacent materials that connect to or that come in contact with the barrier.

B. Shop Drawings: Show locations and extent of air barrier assemblies and details of all typical conditions, intersections with other envelope assemblies and materials, membrane counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated, how materials that cover the air barrier assemblies are secured with air-tight condition maintained, and how miscellaneous penetrations such as conduits, pipes, electric boxes and similar items are sealed.

C. Compatibility Certification: Submit letter from primary material manufacturer stating that materials proposed for use are permanently chemically compatible and adhesively compatible with adjacent materials proposed for use.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Experience: Company experienced in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and trained and skilled personnel.
   2. Supervision: Maintain a competent supervisor who is at Project during times specified work is in progress, and, who is experienced in installing work similar in design, products, and extent to scope of this Project.
   3. Manufacturer Qualification: Trained and certified by manufacturer to apply specified products.

B. Manufacturers Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

C. Mock-Up:
   1. Install mock-up using approved air barrier system including membrane, flashing, joint and detailing compound and related accessories according to manufacturer's written instructions.
      a. Mock-up size of 10 foot square area of wall assembly construction, including a window opening.
      b. Mock-up may remain as part of the work.
   2. Contact manufacturer's representative prior to air barrier application, to perform required mock-up visual inspection and analysis as required by warranty.

D. Pre-Application Conference: Before beginning work of this Section, conduct conference at Project to comply with requirements of appropriate Division 01 Sections.
   1. Required Attendees:

a. Owner.
b. Architect.
c. Contractor, including supervisor.
d. Installers of adjacent work, including supervisors.
e. Manufacturer's technical representative.

2. Minimum Agenda:
a. Review Contract Document requirements.
b. Review approved submittals.
c. Review application procedures, including, but not limited to, following:
1) Surface preparation.
2) Substrate condition and pretreatment.
3) Special details and sheet flashings.
4) Sequence of installation.
5) Protection and repairs.
6) Areas of potential conflict and interface.
d. Review required inspection.
e. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
f. Tour representative areas of required work, discuss and evaluate for compliance with Contract Documents and approved submittals, including substrate conditions, surface preparations, sequence of application, and other preparatory work performed by other installers.

3. Reports: Record discussions, including decisions and agreements reached, and prepare report.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store liquid materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air barrier manufacturer.
B. Remove and replace liquid materials that cannot be applied within their stated shelf life.
C. Store rolls according to manufacturer's written instructions.
D. Protect stored materials from direct sunlight.

1.6 PROJECT CONDITIONS

A. Environmental Limitations:
1. Apply air barrier assembly components within the range of ambient and substrate temperatures recommended by air barrier manufacturer.
2. Protect substrates from environmental conditions that affect performance of air barrier.
3. Do not apply air barrier assembly components to a damp or wet substrate or during snow, rain, fog, or mist.

1.7 WARRANTY

A. Special Manufacturers Warranty: Furnish warranty for a period of 10 years from date of substantial completion agreeing to repair or replace air barrier, signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products manufactured by Dupont Building Innovations to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
1. Fluid-Applied Air Barrier: Tyvek Fluid Applied WB.
2. Through Wall Flashing: Tyvek Thru-Wall Flashing with preformed corners and end dams.
3. Penetration and Termination Sealant: Sealant for Tyvek Fluid Applied System.
4. Transition, Termination, and Detailing Membrane: One of following:
a. StraightFlash.
b. Tyvek Fluid Applied Flashing and Joint Compound.
5. Window Flashing Membrane: One of following:
a. Tyvek Fluid Applied Flashing and Joint Compound.

b. Tyvek Fluid Applied Flashing - Brush Formulation.
c. StraightFlash and FlexWrap.

6. Joint Treatment: One of following depending on size of gap:
   a. 1/4 inch: Tyvek Fluid Applied Flashing and Joint Compound.
   b. 1/2 inch: Tyvek Fluid Applied Flashing and Joint Compound with fiberglass mesh tape.
   c. 1 inch: StraightFlash.

B. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers named alphabetically below. If not named, submit as substitution according to Conditions of the Contract and appropriate Division 01 Sections.

1. BASF Corp.; Enershield-HP.
2. Carlisle Coatings and Waterproofing, Inc.; Barritech VP.
3. Dupont Building Innovations; Tyvek Fluid Applied WB.
4. Grace Construction Products; Perm-A-Barrier VP.
5. Henry Company, Inc.; Air-Bloc 31MR.
6. PROSOCO, Inc.; R-Guard Cat 5.

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. Capable of performing as a continuous vapor-permeable air barrier and as a liquid water drainage plane flashed to discharge to the exterior.
2. Capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Penetration: Not more than 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. pressure difference according to ASTM E 2178 (unmodified).

C. Vapor Permeance: Not less than 10 perms according to ASTM E 96, Method B.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to which fluid-applied membrane air barriers will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, and seal substrate according to air barrier manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier assembly application.

1. Ensure that penetrating work by other trades is in place and complete.
2. Prepare surfaces by brushing, scrubbing, scraping, grinding or compressed air to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion of the fluid-applied membrane.
3. Wipe down metal surfaces to remove release agents or other non-compatible coatings using clean sponges or with a material chemically compatible with the primary air material.

B. Mask off adjoining surfaces not covered by air barrier assemblies to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings.

D. At changes in substrate plane, apply sealant at sharp corners and edges to form a smooth transition from one plane to another.

E. Prepare, treat, rout, and fill cracks, and gaps in substrate according to air barrier manufacturer's written instructions.

F. Treat joints in sheathing according to manufacturer’s instructions.

3.3 APPLICATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
   1. Manufacturer's written instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Apply air barrier assembly products using methods recommended by manufacturer, to achieve a continuous air barrier and a dry film thickness as recommended by the manufacturer.

C. Do not expose air barrier assemblies to sunlight longer than as recommended by the manufacturer.

D. Inspect installation and repair voids, holidays, damaged or non-uniform areas prior to installation of exterior cladding.

3.4 FIELD QUALITY CONTROL

A. Manufacturers Field Inspection: Manufacturers technical representative shall periodically inspect work to ensure application is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings and conclusions of inspection.

3.5 CLEANING AND PROTECTION

A. Protect air barrier assemblies from damage during installation of exterior cladding and for remainder of construction period, according to manufacturer's written instructions.

END OF SECTION

SECTION 07 4114
STANDING SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Standing seam metal roof panels, custom fabricated or on-site roll formed, underlayment, roof insulation, gutters, downspouts, pipe flashing, and accessories necessary to complete installation.

1.2 PERFORMANCE REQUIREMENTS

A. Air Infiltration: Air leakage through assembly of not more than 0.06 cfm/sq ft of roof area when tested according to ASTM E 1680 at following test-pressure difference:
   1. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq ft and greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
   2. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

B. Water Penetration: No water penetration when tested according to ASTM E 1646 at following test-pressure difference:
   1. Positive Preload Test-Pressure Difference: Greater than or equal to 15.0 lbf/sq ft and greater of 75 percent of building live load or 50 percent of building design positive wind-pressure difference.
   2. Negative Preload Test-Pressure Difference: 50 percent of design wind-uplift-pressure difference.

C. Roofing System Design: Metal roof panels identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure indicated.

D. Windstorm Resistance Quality Standard: Products and installation complying with FMG 4471, Windstorm Classification, Class 1-90.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product indicated, specified, or required. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of roof panel and accessory.

B. Shop Drawings – Standing Seam Metal Roof Panels: Detailed and dimensioned fabrication and installation drawings. Distinguish between factory- and field-assembled work.
   1. Include details of edge conditions, side-seam and endlap joints, panel profiles, corners, anchorages, closures, and special details.
   2. Include details for joining and securing panels, pattern of seams, layout of fasteners, cleats, clips, and other attachments.
   3. Include details of termination points and assemblies, including fixed points.
   4. Include details of roof penetrations eaves, ridges, valleys, rakes, crickets, and counterflashings.
   5. Include details of connections to adjoining work.
   6. Include details for gutters and downspouts.
   7. Include copings, showing pattern of seams and layout of fasteners, cleats, clips, and other attachments.

C. Samples for Initial Selection: Full range of standard manufacturer’s colors available, on samples of sheet metal with factory-applied color finishes.

D. Samples for Verification: 12 inch long by actual width of unit, including finished seam and in required profile; include fasteners, cleats, clips, and other attachments.

E. Manufacturer's Project Acceptance Document: Submit certification that manufacturer and installer will warrant roofing system for the specific site, design, details and application indicated for this Project.

F. Portable Roll-Forming Equipment Certificate: Issued by UL for equipment manufacturer's portable roll-forming equipment capable of producing panels which comply with UL requirements.

1. Show expiration date no earlier than two months after scheduled completion of sheet metal roofing.
2. Submit certificates indicating recertification of equipment whose certification has expired during the construction period.

G. Manufacturers Field Inspection Reports: Reports of each visit to Project made by representatives of manufacturer required by "Field Quality Control" Article.

H. Maintenance Data: For inclusion in maintenance manual required by Section 01 7700 – Closeout Procedures.
1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

I. Warranties: Sample of specified warranties.

1.4 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
1. Experience: Company with not less than 5 years experience in custom fabrication of sheet metal roofing, or authorized by portable roll-forming equipment manufacturer, to perform specified Work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Maintain competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
3. Manufacturer Qualification: Certified, approved, licensed, authorized, or acceptable to manufacturer to install specified work.

B. Manufacturers Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

C. Pre-Installation Conference: Before beginning Work of this Section, conduct conference for this Section and other roofing Sections at Project to comply with requirements of applicable Division 01 Sections.
1. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Metal roof panel installer, including supervisor.
   e. Steel deck installer, including supervisor.
   f. Installers of adjacent Work, including supervisors.
   g. Manufacturer's technical representative.
2. Minimum Agenda: Installer shall demonstrate understanding of Work required by reviewing and discussing procedures for, but not limited to, following:
   a. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory Work performed by other installers.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review, discuss, and coordinate installation procedures, including, but not limited to:
      1) Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
      2) Review structural loading limitations of deck during and after roofing.
      3) Roof accessories and roof-mounted equipment.
      4) Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.

e. Review forecasted weather conditions and procedures for coping with unfavorable conditions.

3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver components, sheets, metal roof panels, and other manufactured items so as not to be damaged or deformed. Package metal roof panels for protection during transportation and handling.

B. Handling: Unload, store, and erect metal roof panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Storage: Stack metal roof panels on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal roof panels to ensure dryness. Do not store metal roof panels in contact with other materials that might cause staining, denting, or other surface damage.

1.6 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit metal roof panel work to be performed according to manufacturer's written instructions and warranty requirements.

1.7 WARRANTY

A. Special Manufacturer’s Weathertightness Warranty:

1. Warranty: Single source warranty, without monetary limitation, including both labor and materials, signed by Roofing Membrane Manufacturer, agreeing to warrant the completed system, including roofing membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, gutters, downspouts, and related work to be watertight within 20 years from date of substantial completion.

2. Failures: Include, but are not limited to, following:

a. Structural failures including rupturing, cracking, or puncturing.

b. Deterioration of metals and other materials beyond normal weathering.

B. Special Manufacturer’s Finish Warranty:

1. Warranty: Standard form in which manufacturer agrees to repair finish or replace metal roof panels that show evidence of deterioration of factory-applied finishes within 20 years from date of substantial completion.

2. Deterioration: Includes, but is not limited to, following:

a. Color fading more than 5 Hunter units according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Manufacturer: Berridge Manufacturing Co.

2. Series: Zee-Lock; with continuous Zee-Rib.

3. Color: As selected from manufacturer’s standard colors.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below.

1. Architectural Building Components.

2. Berridge Manufacturing Co.

3. CENTRIA Architectural Systems.

4. Firestone Metal Products; Una-Clad.

5. MBCI; a division of NCI Building Systems, L. P.

6. Petersen Aluminum Corporation.

2.2 SHEET METAL

A. Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.

1. Metal: ASTM A 792, G90 coating designation, aluminum zinc-coated steel sheet, structural quality.
2. Thickness: Nominal 0.022 inch.
3. Surface: Smooth, flat finish.
4. Exterior Exposed Finish: Coil-coated according to following:
   a. Product Quality Standard: AAMA 621.
   b. Metallic Fluoropolymer: Three-coat fluoropolymer finish with suspended metallic flakes containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
   c. Color and Finish: As selected from manufacturer's standard colors available.
5. Concealed Color and Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.
6. Protective Film: Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40; structural quality.

2.3 METAL PANELS

A. Vertical-Rib, Seamed-Joint, Standing-Seam Metal Roof Panels: Formed of metallic-coated steel sheet with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by attaching panels to mechanically attached, concealed, continuous ribs located under one side of panels and engaging opposite edge of adjacent panels, and mechanically seaming panels together.
   1. Panel Width: 16 inches.
   2. Panel Height: 2 inches.
   3. Joint Type: Double folded.

B. Continuous Rib: Manufacturer's standard continuous rib fabricated from aluminum-zinc alloy-coated steel sheet, designed to meet wind uplift.

2.4 UNDERLAYMENT MATERIALS

A. Rubberized Asphalt Underlayment:
   1. Product Quality Standard: ASTM D 1970; except thermally stable after being tested to 240 degrees F.
   2. Description: Minimum 40 mils thick, cold applied, self-adhering sheet consisting of slip-resisting polyethylene-film reinforcing and top surface laminated to rubberized asphalt adhesive, with release-paper backing.
   3. Surface Primer/Conditioner: Product as provided by underlayment manufacturer.
   4. Acceptable Manufacturers and Products:
      a. Carlisle Coatings & Waterproofing Inc.; CCW-WIP-300HT.
      b. Grace Construction Products; Ultra.
      c. Henry Co.; Blueskin PE200HT.
      d. Metal-Fab Manufacturing, LLC; MetShield.
      e. Owens Corning; WeatherLock Metal Hight Temperature Underlayment.
      f. Soprema; Lastobond Shield HT.

2.5 INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application to achieve R value of not less than 30.

B. Faced Board Insulation:
   1. Product Quality Standard: ASTM C 1289.
   2. Description: Type II, Class 1 or 2 felt facing bonded on both sides of rigid closed cell polyisocyanurate foam board.

C. Cover Board:
   1. Product Quality Standard: ASTM C 1177.
   2. Description: Glass-mat, water-resistant gypsum substrate, 1/2 inch, factory primed.

D. Insulation Fasteners:
1. Factory-coated steel fasteners, with buttress type threads, and metal plates complying with corrosion-resistance provisions in FM Approvals 4470.
2. Specifically designed and sized for fastening specified board insulation to metal decking to resist uplift pressure at corners, perimeter, and field of roof.
3. Tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

2.6 SPECIALTIES

A. Flashing and Trim:
1. Formed from same material as roof panels, prepainted with coil coating, minimum 0.022 in thick.
2. Provide flashing and trim as required to seal against weather and to provide finished appearance.
3. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.
4. Finish flashing and trim with same finish system as adjacent metal roof panels.

B. Gutters:
1. Formed from same material roof panels.
2. Match profile of gable trim, complete with end pieces, outlet tubes, and other special pieces as required.
3. Fabricate in minimum 96 in long sections, of size and metal thickness according to SMACNA's Architectural Sheet Metal Manual.
4. Furnish gutter supports spaced a maximum of 36 in o.c., fabricated from same metal as gutters.
5. Provide wire ball strainers of compatible metal at outlets.
6. Finish gutters to match metal roof panels.

C. Downspouts:
1. Formed from same material as roof panels.
2. Fabricate in 10 foot long sections, complete with formed elbows and offsets, of size and metal thickness according to SMACNA's "Architectural Sheet Metal Manual".
3. Finish downspouts to match gutters.

D. Pipe Flashing: Premolded, EPDM pipe collar with flexible aluminum ring bonded to base.

2.7 ACCESSORIES

A. Roof Panel Accessories: Provide components approved by roof panel manufacturer and as required for a complete metal roof panel assembly including trim, copings, fasciae, corner units, ridge closures, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal roof panels unless otherwise indicated.
1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal roof panels.
2. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1 inch thick, flexible closure strips; cut or premolded to match metal roof panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.
3. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

B. Fasteners: Suitable fasteners designed to withstand design loads.
1. Exposed Fasteners: Heads matching color of sheet metal roofing using plastic caps or factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
3. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
4. Fasteners for Steel Sheet: Hot-dip galvanized steel according to ASTM A 153, ASTM F 2329, or Series 300 stainless steel.

C. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15 mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

D. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 in wide and 1/8 in thick.

E. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

F. Joint Sealant: ASTM C 920; elastomeric silicone sealant; of type, grade, class, and use classifications required to seal joints in metal roof panels and remain weathertight; and as recommended in writing by metal roof panel manufacturer.

2.8 FABRICATION

A. Fabrication Quality Standard: SMACNA's Architectural Sheet Metal Manual.

B. Metal Roof Panels:

1. Fabricate and finish metal roof panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes and as necessary to fulfill indicated performance requirements.
2. Comply with indicated profiles and with dimensional and structural requirements.
3. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.
4. Fabricate metal roof panel side laps with factory-installed captive gaskets or separator strips that provide a tight seal and prevent metal-to-metal contact, in a manner that will seal weathertight and minimize noise from movements within panel assembly.

C. Specialties and Accessories: Fabricate flashing and trim to comply with recommendations in fabrication quality standard that apply to the design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. End Seams: Fabricate nonmoving end seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Form nonexpansion sealed but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices of size and metal thickness recommended by SMACNA's "Architectural Sheet Metal Manual" or by metal roof panel manufacturer for application, but not less than thickness of metal being secured.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive standing seam metal roof panels and associated work for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

B. Verify that substrate is sound, dry, smooth, clean, and securely anchored.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation, including removing projections capable of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. SMACNA's Architectural Sheet Metal Manual.
2. Respective manufacturer’s installation instructions.

3. Approved submittals.
4. Contract Documents.

3.4 INSULATION INSTALLATION

A. Procedures: Install in 2 layers to achieve thermal value specified.
1. Install bottom layer of insulation to deck using mechanical fasteners, with long sides in a continuous straight line perpendicular to roof decking flutes, with end joints staggered between rows, abutting edges and ends between boards.
2. Install top layer of insulation using mechanical fasteners, with joints of top layer staggered from joints of bottom layer not less than 6 inches in each direction.
3. Fill gaps exceeding 1/4 inch with insulation.
4. Cut and fit within 1/4 inch of nailers, projections, and penetrations.

3.5 COVER BOARD INSTALLATION

A. Procedures:
1. Install cover board on insulation using mechanical fasteners, with long sides in a continuous straight line perpendicular to roof decking flutes, with end joints staggered between rows, abutting edges and ends between boards.
2. Cut and fit within 1/4 inch of nailers, projections, and penetrations.

3.6 UNDERLAYMENT INSTALLATION

A. Procedures:
1. Apply primer if required by manufacturer.
2. Apply over entire roof surface wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inch staggered 24 inches between courses.
3. Overlap edges not less than 3-1/2 inches and roll laps with roller.
4. Cover underlayment within time period required by manufacturer.

3.7 FLASHING INSTALLATION

A. Rake Drip Edges: Install rake drip edge flashings under underlayment and fasten to roof deck.
B. Eave Drip Edges: Install eave drip edge flashings below underlayment and fasten to roof sheathing.
C. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.8 METAL PANEL INSTALLATION

A. Thermal Movement. Rigidly fasten metal roof panels to structure at one and only one location for each panel. Allow remainder of panel to move freely for thermal expansion and contraction. Predrill panels for fasteners.
B. Roof Panel Procedures: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners required for performance requirements.
1. Commence installation and install not less than 300 sq ft in presence of factory-authorized representative.
2. Provide panels of full length from eave to ridge.
3. Locate and space fastenings in uniform vertical and horizontal alignment.
4. Install continuous ribs to supports with screws extending through insulation into steel deck.
5. Install pressure plates at locations indicated in manufacturer's written installation instructions.
6. If required by manufacturer, nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.
7. Crimp standing seams with manufacturer-approved, motorized seamer tool so cleat, insulated metal roof panel, and factory-applied side-lap sealant are completely engaged.

C. Metal Protection:
1. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating, by applying rubberized-asphalt underlayment to each contact surface, or by other permanent separation as recommended by metal roof panel manufacturer.

2. Coat back side of roof panels with bituminous coating where roof panels will contact wood, ferrous metal, or cementitious construction.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of metal roof panel assemblies. Provide types of gaskets, fillers, and sealants indicated or, if not indicated, types recommended by metal roof panel manufacturer.
1. Seal metal roof panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal roof panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07 9200 - Joint Sealants.

E. Installation Tolerances: Shim and align metal roof panel units within installed tolerance of 1/4 in in 20 ft on slope and location lines as indicated and within 1/8 in offset of adjoining faces and of alignment of matching profiles.

3.9 SPECIALTIES INSTALLATION

A. Gutters:
1. Join sections with riveted and soldered or lapped and sealed joints.
2. Attach gutters to eave with gutter hangers spaced not more than 36 in o.c. using manufacturer's standard fasteners.
3. Provide end closures and seal watertight with sealant.
4. Provide for thermal expansion.

B. Downspouts:
1. Join sections with telescoping joints.
2. Provide fasteners designed to hold downspouts securely 1 in away from walls; locate fasteners at top and bottom and at approximately 60 in o.c. in between.
3. Provide elbows at base of downspouts to direct water away from building.

C. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.10 ACCESSORY INSTALLATION

A. General:
1. Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion.
2. Coordinate installation with flashings and other components.
3. Install components required for a complete metal roof panel assembly including trim, copings, ridge closures, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items.

B. Flashing and Trim: Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work according to manufacturer’s typical details, or for non-typical details with manufacturer’s approval, with laps, joints, and seams that will be permanently watertight and weather resistant.
1. Install exposed flashing and trim 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.
2. Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft with no joints allowed within 24 in of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently weather resistant and waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 in deep, filled with mastic sealant (concealed within joints).
3. Install metal closures at rake edges rake walls and each side of ridge and hip caps.
4. Flash and seal metal roof panels with weather closures at eaves, rakes, and perimeter of all openings.
5. Install ridge and hip caps as metal roof panel work proceeds.
6. Locate panel end splices over, but not attached to, structural supports. Stagger panel end splices to avoid a four-panel splice condition.
7. Install metal flashing to allow moisture to run over and off metal roof panels.

3.11 FIELD QUALITY CONTROL

A. Manufacturers Field Inspection:

1. Manufacturer's technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements.
2. Representative shall submit written reports of each visit indicating observations, findings and conclusions of inspection.

3.12 CLEANING

A. Protective Coverings: Remove strippable films, if any, as metal roof panels are installed unless otherwise indicated in manufacturer's written installation instructions.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 07 5216
SBS MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Styrene-butadiene-styrene (SBS) modified bituminous membrane roofing, roof insulation, and accessories necessary to complete installation.

1.2 DEFINITIONS

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

B. Hot Roofing Asphalt: Roofing asphalt heated to its equiviscous temperature, the temperature at which its viscosity is 125 centipoise for mop-applied roofing asphalt and 75 centipoise for mechanical spreader-applied roofing asphalt, within a range of plus or minus 25 deg F, measured at the mop cart or mechanical spreader immediately before application.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Withstand uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Membrane roofing and base flashings shall remain watertight.

B. Material Compatibility: Roofing materials that are compatible with one another under conditions of service and application required, as demonstrated by membrane roofing manufacturer based on testing and field experience.

C. Roofing System Design: Roofing system identical to systems that have been successfully tested by qualified testing and inspecting agency to resist uplift pressure indicated.

D. FM Approvals Listing: Provide membrane roofing, base flashings, and component materials that comply with requirements in FM Approvals 4450 and FM Approvals 4470 as part of a membrane roofing system, and that are listed in FM Approvals' "RoofNav" for Class 1 or noncombustible construction, as applicable. Identify materials with FM Approvals markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance Rating: SH.

1.4 SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product indicated, specified, or required.

B. Shop Drawings: Detailed and dimensioned plans and large-scale details, indicating, but not limited to, following:

1. Base flashings and membrane terminations.
2. Tapered insulation, including slopes.
3. Crickets, saddles, and tapered edge strips, including slopes.
4. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
5. Attachments to other work.

C. Manufacturers Field Inspection Reports: Reports of each visit to Project made by representatives of manufacturer required by “Field Quality Control” Article.

D. Maintenance Data: For inclusion in operation and maintenance manual required by Division 01 Section “Closeout Procedures.”

1. Include manufacturer’s instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

E. Warranty: Sample of specified warranty.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Company with not less than 5 years experience in performing specified Work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Maintain competent supervisor who is at Project during times specified

Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

3. Manufacturer Qualification: Certified, approved, licensed, authorized, or acceptable to manufacturer to install specified work.

B. Source Limitations: Obtain each type of metal roof panels from single source from single manufacturer.

C. Manufacturers Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

D. Pre-Installation Conference: Before beginning Work of this Section, conduct conference for this Section and other roofing Sections at Project to comply with requirements of applicable Division 1 Sections.

1. Required Attendees:
   a. Owner.
   b. Architect.
   c. Contractor, including supervisor.
   d. Metal roof panel installer, including supervisor.
   e. Steel deck installer, including supervisor.
   f. Roof-mounted equipment installers, including supervisor.
   g. Installers of adjacent Work, including supervisors.
   h. Manufacturer's technical representative.
2. Minimum Agenda: Installer shall demonstrate understanding of Work required by reviewing and discussing procedures for, but not limited to, following:
   a. Tour representative areas of required Work, discuss and evaluate for compliance with Contract Documents, including substrate conditions, surface preparations, sequence of installation and other preparatory Work performed by other installers.
   b. Review Contract Document requirements.
   c. Review approved submittals.
   d. Review, discuss, and coordinate installation procedures, including, but not limited to:
      1) Examine deck substrate conditions for compliance with requirements, including flatness and attachment to structural members.
      2) Review structural loading limitations of deck during and after roofing.
      3) Roof accessories and roof-mounted equipment.
      4) Flashings, special roof details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that will affect metal roof panels.
   e. Review forecasted weather conditions and procedures for coping with unfavorable conditions.
3. Reports: Record discussions, including decisions and agreements reached, and furnish copy of record to each party attending.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

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

D. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.

1.7 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather

conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.8 WARRANTY

A. Special Manufacturer's Warranty: Standard form, without monetary limitation, in which manufacturer agrees to repair or replace components of membrane roofing system (including products from edge to edge and deck up) that fail in materials or workmanship within 20 years from date of substantial completion.

B. Special Installers Warranty: Submit roofing Installer's warranty covering the Work of this Section, including all components of membrane roofing system such as membrane roofing, base flashing, roof insulation, fasteners, cover boards, for two years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below. If not listed, submit as substitution according to Conditions of the Contract and Division 1 Sections.

1. Firestone Building Products.
2. GAF Materials Corporation.
3. Johns Manville.
4. Siplast, Inc.
5. Soprema.
6. TAMKO Building Products, Inc.

2.2 ROOFING MEMBRANE MATERIALS

A. Roofing Membrane Sheet: ASTM D 6163, Type I, Grade S, SBS-modified asphalt sheet with glass fiber reinforcing mat; smooth surfaced; suitable for application method specified.

B. Granule-Surface Roofing Membrane Cap Sheet: ASTM D 6163, Type I, Grade G, SBS-modified asphalt sheet with glass fiber reinforcing mat; white granular surfaced; suitable for application method specified.

2.3 BASE FLASHING SHEET MATERIALS

A. Backer Sheet: ASTM D 6162, Grade S, Type I or II, SBS-modified asphalt sheet (reinforced with a combination of polyester fabric and glass fibers); smooth surfaced; suitable for application method specified.

B. Metal-Foil-Surfaced Flashing Sheet: ASTM D 6298, aluminum-foil surfaced SBS-modified asphalt sheet (reinforced with glass fibers); suitable for application method specified, and as follows:

2.4 AUXILIARY ROOFING MEMBRANE MATERIALS

A. Liquid Flashing: Membrane manufacturer’s standard system including primer and multi-component, cold fluid-applied, high-solids, methyl methacrylate (PMMA) liquid resin, when catalyzed, and combined with non-woven, needle-punched, polyester fabric fleece forms a monolithic, reinforced flashing membrane.

B. Roofing Asphalt: ASTM D 6152, SEBS modified.

C. Mastic Sealant: Polyisobutylene, plain or modified bitumen; nonhardening, nonmigrating, nonskinning, and nondrying.

D. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing membrane components to substrate; tested by manufacturer for required pullout strength, and acceptable to roofing system manufacturer.

E. Metal Flashing Sheet: As specified in Division 07 Section “Flashing and Sheet Metal.”

F. Roofing Granules: Ceramic-coated roofing granules, No. 11 screen size with 100 percent passing No. 8 sieve and 98 percent of mass retained on No. 40 sieve, color to match roofing membrane.

G. Miscellaneous Accessories: Provide those recommended by roofing system manufacturer.

2.5 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by roofing manufacturer, selected from manufacturer's standard sizes suitable for application, of thicknesses indicated.

B. Faced Polyisocyanurate Board Insulation: ASTM C 1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces; R value of not less than 30.

C. Provide preformed saddles, crickets, tapered edge strips, and other insulation shapes where indicated for sloping to drain. Fabricate to slopes indicated.

2.6 ROOF INSULATION ACCESSORIES

A. General: Furnish roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with membrane roofing.

B. Fasteners: Factory-coated steel fasteners meeting corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation to deck type to resist uplift pressure at corners, perimeter, and field of roof; include metal or plastic fastener plates; acceptable to roofing system manufacturer.

C. Insulation Cant Strips: ASTM C 208, Type II, Grade 1, cellulosic-fiber insulation board.

D. Wood Nailer Strips: Comply with requirements in Division 06 Section “Miscellaneous Rough Carpentry.”

E. Cover Board: ASTM C 1177, glass-mat, water-resistant gypsum substrate, 1/2 inch thick, factory primed for hot asphalt mopping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to which SBS modified bituminous membrane roofing will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

B. Verifications:

1. Verify that roof openings and penetrations are in place and curbs are set and braced and that roof drain bodies are securely clamped in place.
2. Verify that wood cants, blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements.
4. Verify that deck is securely fastened with no projecting fasteners and with no adjacent units in excess of 1/16 inch out of plane relative to adjoining deck.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. ARMA/NRCA's "Quality Control Guidelines for the Application of Polymer Modified Bitumen Roofing."
2. Respective manufacturer’s written installation instructions.
3. Approved submittals.
4. Contract Documents.

3.4 INSULATION INSTALLATION

A. General: Install insulation and gypsum cover boards to resist uplift pressure at corners, perimeter, and field of roof.

B. Insulation:

1. Install tapered insulation under area of roofing to conform to slopes indicated.

2. Mechanically fasten insulation with long joints in a continuous straight line with end joints staggered between rows, abutting edges and ends between boards. Fill gaps exceeding 1/4 inch with insulation.
3. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
4. Install insulation under area of roofing to achieve required thickness in two or more layers with joints of each succeeding layer staggered from joints of previous layer a minimum of 6 inches in each direction.

C. Gypsum Cover Boards: Mechanically fasten over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints a minimum of 6 inches in each direction from joints of insulation below. Loosely butt cover boards together.

D. Insulation Cant Strips: Install and secure preformed 45-degree insulation cant strips at junctures of roofing membrane system with vertical surfaces or angle changes more than 45 degrees.

3.5 ROOFING MEMBRANE INSTALLATION, GENERAL

A. Install roofing membrane system according to following:
1. Deck Type: I (insulated).
2. Adhering Method: M (mopped).
3. Number of SBS-Modified Asphalt Sheets: Two.
4. Surfacing Type: M (mineral-granule-surfaced cap sheet).

B. Start installation of roofing membrane in presence of roofing system manufacturer's technical personnel.

C. Coordinate installation of roofing system so insulation and other components of roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at the end of workday or when rain is forecast.
1. At end of each day's work, provide tie-offs to cover exposed roofing membrane sheets and insulation with a course of coated felt set hot roofing asphalt, with joints and edges sealed.
2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
3. Remove and discard temporary seals before beginning work on adjoining roofing.

D. Asphalt Heating: Heat and apply roofing asphalt according to roofing system manufacturer's written instructions.

E. Substrate-Joint Penetrations: Prevent roofing asphalt and adhesives from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

3.6 SBS-MODIFIED BITUMINOUS MEMBRANE INSTALLATION

A. Install modified bituminous roofing membrane sheet and cap sheet according to roofing manufacturer's written instructions, starting at low point of roofing system. Extend roofing membrane sheets over and terminate beyond cants, installing as follows:
1. Adhere to substrate in a solid mopping of hot roofing asphalt applied at not less than 425 deg F.
2. Unroll roofing membrane sheets and allow them to relax for minimum time period required by manufacturer.

B. Laps: Accurately align roofing membrane sheets, without stretching, and maintain uniform side and end laps. Stagger end laps. Completely bond and seal laps, leaving no voids.
1. Repair tears and voids in laps and lapped seams not completely sealed.
2. Apply roofing granules to cover exuded bead at laps while bead is hot.
3. Install roofing membrane sheets so side and end laps shed water.

3.7 FLASHING AND STRIPPING INSTALLATION

A. Install base flashing over cant strips and other sloped and vertical surfaces, at roof edges, and at penetrations through roof; secure to substrates according to roofing system manufacturer's written instructions, and as follows:
1. Backer Sheet Application: Adhere backer sheet to substrate in a solid mopping of hot roofing asphalt.
2. Flashing Sheet Application: Adhere flashing sheet to substrate in a solid mopping of hot

roofing asphalt applied at not less than 425 deg F. Apply hot roofing asphalt to back of flashing sheet if recommended by roofing system manufacturer.

B. Extend base flashing up walls or parapets a minimum of 8 inches above roofing membrane and 4 inches onto field of roofing membrane.

C. Mechanically fasten top of base flashing securely at terminations and perimeter of roofing.

D. Install roofing membrane cap sheet stripping where metal flanges and edgings are set on membrane roofing according to roofing system manufacturer's written instructions.

3.8 LIQUID FLASHING INSTALLATION

A. Apply liquid flashing to following penetration conditions not otherwise scheduled for metal flashings or membrane base flashings:
   1. Electrical conduit.
   2. Pipes.
   3. Unusually shaped penetrations.
   4. Roof drains.
   5. Scuppers.
   6. Waste vent.

B. Mix and apply primer according to manufacturer’s recommended coverage rate.

C. Mix and apply first coat of resin according to manufacturer’s recommended coverage rate.

D. Lay fleece onto liquid resin, avoiding air bubbles, folds and wrinkles, and work into resin with roller or brush.

E. Apply additional coat of resin on top of fleece according to manufacturer’s recommended coverage rate.

F. Broadcast granules into wet resin.

3.9 FIELD QUALITY CONTROL

A. Manufacturers Field Inspection: Manufacturers technical representative shall periodically inspect Work to ensure installation is proceeding in accordance with manufacturer’s designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings and conclusions of inspection.

3.10 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

SECTION 07 6200
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Flashing, sheet metal, and accessories indicated, specified, or required to complete installation.

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, rattling, leaking, and fastener disengagement.

B. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Detailed and dimensioned plans, elevations, large-scale details of sheet metal flashing and trim. Distinguish between shop- and field-assembled work. Include following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.
4. Details of expansion-joint covers, including showing direction of expansion and contraction.
5. Details showing interface and relationship to adjacent materials.

1.4 QUALITY ASSURANCE

A. Quality Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Installer Qualifications:

1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Available Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into Work include but are not limited to those listed.

2.2 METAL FLASHING MATERIALS

A. Coil-Coated, Metallic-Coated Steel Sheet: Restricted flatness steel sheet metallic coated by hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.

1. Metal: ASTM A 792, G90 coating designation, aluminum zinc-coated steel sheet, structural quality.
2. Thickness: 22 gage.
3. Surface: Smooth, flat finish.
4. Exterior Coil-Coated Finish:
   a. Product Quality Standard: AAMA 620.
   b. Two-Coat Fluoropolymer: Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written

instructions.

c. Color and Finish: Match color selected for sheet metal specified in Section 07 4114 - Standing Seam Metal Roof Panels.

5. Concealed Color and Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish, consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

6. Protective Film: Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective film before shipping.

B. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 coating designation; structural quality, mill phosphatized for field painting, not less than 0.028 in thick (24 gage) nominal unless otherwise indicated.

C. Lead Sheet: ASTM B 749, Type L51121, copper-bearing lead sheet, not less than 0.0625 in thick unless otherwise indicated.

2.3 UNDERLAYMENT MATERIALS

A. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

B. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: ASTM D 1970; stable after testing at 240 deg F.
2. Low-Temperature Flexibility: ASTM D 1970; passes after testing at minus 20 deg F.
3. Available Manufacturers and Products:
   a. Carlisle Coatings & Waterproofing; CCW WIP 300HT.
   b. Grace Construction Products, a unit of W. R. Grace & Co.; Ultra.
   c. Henry Company; Blueskin PE200 HT.
   d. Metal-Fab Manufacturing, LLC; MetShield.
   e. Owens Corning; WeatherLock Metal High Temperature Underlayment.

2.4 ACCESSORIES

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Material: Same metal as sheet metal flashing or other noncorrosive metal as recommended by sheet metal manufacturer.
2. Finish: Match finish of exposed heads with material being fastened.
3. Exposed Fasteners: Self-drilling screws, gasketed, with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

C. Solder for Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

D. Solder for Lead: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

E. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

F. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

H. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in

SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop-fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

D. Fabricate reglets formed to provide secure interlocking of separate reglet and counterflashing pieces with factory mitered and continuously welded corners; and counterflashings of heights to overlap top edges of base flashings by 4 inches designed to snap into reglets and compress against base flashings with joints lapped.

E. Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

F. Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 in (25 mm) deep, filled with butyl sealant concealed within joints.

G. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

H. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal. Thickness As recommended by SMACNA's "Architectural Sheet Metal Manual" and FMG Loss Prevention Data Sheet 1-49 for application but not less than thickness of metal being secured.

I. Fabricate inside and outside corners, intersections, and complex flashing conditions in shop with properly folded, constructed and soldered joints.

J. Exposed edges of metal flashing shall be folded and hemmed.

2.6 PARAPET COPINGS

A. Description: Formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage; corner units, end cap units, and concealed splice plates with same finish as coping caps.

B. Material: Coil-coated, metallic-coated steel sheet.

C. Fabrication Quality Standard: SMACNA Figure 3-7A.
   1. Corners: C1.
   2. Edge: E1.
   3. Joint: J5 (6 in wide cover and 12 in wide drainage pan under coping joint.

D. Changes in Direction: Factory mitered and continuously welded.

E. Attachment Method:
   1. Outside (visible) leg hooked to concealed, continuous galvanized-steel sheet hook.
   2. Back (roofside) leg fastened with exposed gasketed fasteners.

2.7 REGLET AND COUNTERFLASHINGS

A. Description: Formed to overlap top edges of base flashings and under copings or wall finish materials; reglet for attaching to substrate with counterflashing designed to snap into receiver and compress against base flashing; joints lapped not less than 4 inches.

B. Material: Zinc-coated (galvanized) steel sheet.

C. Fabrication Quality Standard: SMACNA Figure 4-4D, except shaped to fit conditions.

D. Changes in Direction: Factory mitered and continuously welded.

E. Joints: Lapped and sealed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates surfaces to receive flashing and sheet metal systems and associated work and conditions under which work will be installed. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to Installer. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. Respective manufacturer's installation instructions.
2. Approved submittals.
3. Contract Documents.

3.3 UNDERLAYMENT INSTALLATION

A. Felt Underlayment: Install with adhesive for temporary anchorage to minimize use of mechanical fasteners under roof specialties. Apply in shingle fashion to shed water, with lapped joints of not less than 2 in.

B. Self-Adhering Sheet Underlayment: Install wrinkle free. Apply primer if required by underlayment manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation; use primer rather than nails for installing underlayment at low temperatures. Apply in shingle fashion to shed water. Overlap edges not less than 3-1/2 in. Roll laps with roller. Cover underlayment within 14 days.

3.4 METAL FLASHING INSTALLATION

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

B. Metal Protection: Where dissimilar metals will contact each other or other substrates that have potential of causing corrosion, protect metal flashings by one of the following:
   1. Bituminous Coating: Coat side of stainless-steel and lead sheet metal flashing and trim with bituminous coating where flashing and trim will contact ferrous metal.
   2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, self-adhering, high-temperature sheet underlayment or polyethylene sheet.
   3. Asphalt Roofing Cement: Bed flanges in thick coat where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal. Space cleats not more than 12 in apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft with no joints allowed within 24 in of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 in deep, filled with butyl sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 in for nails and not less than 3/4 in for wood screws. Use stainless-steel fasteners unless otherwise recommended by material manufacturer.

H. Seal joints with elastomeric or butyl sealant as required for watertight construction.
   1. At concealed sealant joints, embed hooked flanges of joint members not less than 1 in into butyl sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 deg F and 70 deg F, set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F.
   2. At exposed sealant joints, prepare joints and apply elastomeric sealants to comply with requirements in Division 07 Section "Joint Sealants."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 in except where pretinned surface would show in finished Work.

J. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder

into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

K. Coordinate installation of reglets and counterflashings with installation of base flashings. Install reglets at height so that inserted counterflashings overlap 4 inches over top edge of base flashings. Insert counterflashings into reglets or other indicated receivers; ensure that counterflashings overlap 4 inches over top edge of base flashings. Lap counterflashing joints a minimum of 4 inches and bed with elastomeric sealant. Fit counterflashings tightly to base flashings

3.5 CLEANING AND PROTECTION

A. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

B. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 07 9200
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Joint sealants, backing materials, and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each joint sealant product and accessory indicated, specified, or required.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing full range of colors available for each product exposed to view.

C. Samples for Verification: Samples for each kind and color of joint sealants in 1/2 in wide joints formed between two 6 in strips of material matching appearance of exposed surfaces adjacent to joint sealants.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Installer with minimum of 5 years specialized experience in performing specified Work similar in design, material and extent to scope of Project, and with a record of successful in-service performance.
2. Supervision: Installer shall maintain a competent supervisor who is on job site during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required.

B. Mock-Ups:

1. Before beginning Work of this Section, install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section.
2. Use materials and installation methods specified in this Section.
3. Provide as many mock-ups as required until approved.

1.4 FIELD CONDITIONS

A. Ambient Conditions: Proceed with installation of joint sealants under following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

B. Weather Conditions Limitation: Proceed with Work only when existing and forecasted weather conditions will permit installation according to manufacturer's instructions and warranty requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed alphabetically below.

2.2 MATERIALS, GENERAL

A. Compatibility: Joint sealants, backings, and other related materials shall be compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

B. Single Source Responsibility: Furnish each type of joint sealant from single manufacturer.

C. Suitability for Contact with Food: Comply with authorities having jurisdiction for joints in repeated contact with food.

2.3 EXTERIOR ELASTOMERIC SEALANTS

A. Exterior Pourable Urethane Sealant:

1. Product Quality Standard: ASTM C 920, Type M, Grade P, Class 25, Use T.

2. Description: Multi-component, pourable, moisture curing, polyurethane sealant; rated for incline when used on sloped surfaces.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Available Manufacturers and Products:
   a. BASF; Sonolastic SL 2.
   b. May National Associates, Inc.; Bondaflex PUR 35SL.
   c. Pecora Corp.; Urexpan NR-200.
   d. Sika Corp., Construction Products Div.; Sikaflex 1CSL.
   e. Tremco Commercial Sealants & Waterproofing; THC-900/THC-901.
6. Color: As selected from manufacturer's standard colors.

B. Exterior Non-sag Silicone Sealant – Class 50:
1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 50.
2. Description: Single component, non-sag, neutral cure, non-staining as determined by pre-construction stain testing, and non-bleeding, silicone sealant.
3. Joint Movement Capability: Plus 50 percent, minus 50 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Available Manufacturers and Products:
   a. Dow Corning; 795 Silicone Building Sealant.
   b. May National Associates, Inc.; Bondaflex Sil 295.
   c. Momentive Performance Materials, GE Silicones; Silpruf SCS2000.
   d. Pecora Corp.; 864NST.
   e. Tremco Commercial Sealants & Waterproofing; Spectrem 3.
   f. Sika; SikaSil 295.
6. Color: As selected from manufacturer's standard colors.

2.4 INTERIOR ELASTOMERIC SEALANTS

A. Interior Non-sag Silicone Sealant:
1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25.
2. Description: Single component, non-sag, moisture curing, silicone sealant specially formulated with fungicide for use in sanitary non-porous applications.
3. Available Manufacturers and Products:
   a. Dow Corning; 786 Silicone Sealant.
   b. Momentive Performance Materials, GE Silicones; Sanitary SCS1700.
   c. Pecora Corp.; 898.
   d. Tremco Commercial Sealants & Waterproofing; Tremsil 200.
   e. Sika; SikaSil GP or SikaSil GN Plus.
4. Color: As selected from manufacturer's standard colors.

B. Interior Non-sag Acrylic Latex Sealant:
1. Product Quality Standard: ASTM C 834, Type and Grade as required by conditions.
2. Description: Single component, non-sag, moisture curing, general purpose, paintable, siliconized acrylic latex sealant.
3. Joint Movement Capability: Plus 7.5 percent, minus 7.5 percent
4. Available Manufacturers and Products:
   a. BASF; Sonolac.
   b. Pecora Corp.; AC 20.
   c. Tremco Commercial Sealants & Waterproofing; Tremflex 834.
5. Color: As selected from manufacturer's standard colors.

C. Interior Non-sag Urethane Sealant:
1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35.
2. Description: Single component, non-sag, moisture curing, non-staining as determined by pre-construction stain testing if exposed, polyurethane sealant.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Available Manufacturers and Products:

a. BASF; Sonolastic NP 1.
b. Pecora Corp.; Dynatrol I-XL.
c. Tremco Commercial Sealants & Waterproofing; Dymonic or Vulkem 116.

6. Color: As selected from manufacturer's standard colors.

2.5 JOINT SEALANT BACKING

A. Foam Backer Rods:
1. Product Quality Standard: ASTM C 1330, Type C, Type O, Type B.
2. Description: Extruded polyethylene, polyurethane, or polyolefin in either closed cell structure (Type C), open cell structure (Type O), or bicellular structure with surface skin (Type B) as defined by ASTM Terminology C 717.
3. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
4. Available Manufacturers and Products:
a. Type C:
1) BASF; Sonneborn, Closed-Cell Backer Rod.
2) Nomaco Inc.; Green Rod or HBR.
b. Type O:
1) Backer Rod Mfg. Inc.; Denver Foam.
2) Nomaco Inc.; Foam-Pak II.
c. Type B:
1) BASF; Sonneborn, Soft Backer Rod.
2) Nomaco Inc.; Dual-Rod or Sof-Rod.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 ACCESSORIES

A. Cleaners for Non-porous 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 non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

B. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to receive joint sealants and associated Work to which joint sealants will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Cleaning of Joints: Clean out joints immediately before installing joint backings and sealants to comply with joint sealant manufacturer's written instructions and following requirements:
1. Remove foreign material that could interfere with adhesion of joint sealant, including, but not limited to, 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, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form-release agents from concrete.

4. Clean non-porous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Joint Priming:
1. Prime joint substrates where recommended by joint sealant manufacturer, or as indicated by prior experience, or as required by pre-construction compatibility and adhesion testing. Apply primer to comply with joint sealant manufacturer's written instructions.
2. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape:
1. Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears.
2. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. ASTM C 1193 for use of joint sealants as applicable to materials, applications, conditions indicated, and following profile configurations:
a. Fillet: Figure 5.
b. Bridge: Figure 6.
c. Butt: Figure 8A (concave tooling), generally hour-glass shape with 2:1 width-to-depth ratio.
2. Substrate material allowed by sealant’s ASTM C 920 Use Classification.
3. Respective manufacturer’s written installation instructions.
4. Approved submittals.
5. Contract Documents.

B. Joint Sealant Backings: Install of kind 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 stretching, twisting, puncturing, or tearing backings.
3. Remove absorbent sealant backings that have become wet or damaged before sealant application and replace with dry materials.
4. Install bond-breaker tape behind sealants where backings are not used between sealants and backs of joints.

C. Joint Sealants: Install at same time as backings using proven techniques that comply with following:
1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
4. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs 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.
a. Remove excess sealant from surfaces adjacent to joints.
b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
c. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. In-Progress Cleaning: Remove excess sealant or sealant smears adjacent to joints as 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. General Requirements:
   1. Protect 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.
   2. 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 original Work.

3.6 JOINT SEALANT SCHEDULE

A. Exterior Elastomeric Sealant Schedule:
   1. Exterior Pourable Urethane Sealant: Moving joints in exterior concrete walks and drives.
   2. Exterior Non-sag Silicone Sealant – Class 50: Moving joints on exterior side of exterior walls.

B. Interior Elastomeric Sealant Schedule:
   1. Interior Non-sag Silicone Sealant:
      a. Non-moving joints in moist or damp areas which are susceptible to mildew.
      b. Non-moving joints in kitchens and toilet rooms.
      c. Non-moving joints in repeated contact with food.
   2. Interior Non-sag Acrylic Latex Sealant: Non-moving joints where another type of sealant is not otherwise specified or scheduled.
   3. Interior Non-sag Urethane Sealant: Joints on interior side of exterior walls where joint movement is anticipated.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 07 9500
EXPANSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Architectural joint systems for building interiors.

1.2 SUBMITTALS

A. Shop Drawings: Provide sections and details for each joint system specified.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
   1. Manufacturer: Construction Specialties
   2. Floor-to-Floor Model Number: GFS-100.
   3. Wall-to-Wall Model Number: FWF-100.
   4. Ceiling-to-Ceiling Model Number: FWF-100.

2.2 MATERIALS

A. Aluminum:
   1. ASTM B 221, Alloy 6063-T5 for extrusions
   2. ASTM B 209, Alloy 6061-T6 for sheet and plate.

B. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.

2.3 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

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 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where architectural joint systems will be installed for installation tolerances and other conditions affecting performance of work.
   1. Proceed with installation only after unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   2. Starting work within a particular area will be construed as applicator's acceptance of surface conditions.

3.2 PREPARATION

A. Prepare substrates according to architectural joint system manufacturer's written instructions.

B. Repair concrete slabs using manufacturer's recommended repair grout of compressive strength adequate for anticipated structural loadings.

C. Coordinate and furnish anchorages, setting drawings, and instructions for installing joint systems. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of joint systems.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for installing architectural joint assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install joint systems.
   1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.

2. Locate anchors at interval recommended by manufacturer, but not less than 3 in from each end and not more than 24 in o.c.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

END OF SECTION

SECTION 08 1113
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Hollow metal doors and frames and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required.
   1. Include manufacturer's written installation instructions.
   2. Include construction details, material descriptions, core descriptions, and finishes.

B. Shop Drawings: Scaled and dimensioned drawings of products to be incorporated into Work:
   1. Elevations of each door design.
   2. Details of doors including vertical and horizontal edge details and metal thicknesses.
   3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
   4. Locations of reinforcement and preparations for hardware.
   5. Details of each different wall opening condition.
   6. Details of anchorages, joints, field splices, and connections.
   7. Details of accessories.
   8. Details of moldings, removable stops, and glazing.
   9. Details of conduit and preparations for power, signal, and control systems.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and storage.

B. Storage:
   1. Store hollow metal work under cover.
   2. Place in stacks of 5 units maximum in vertical position with heads up, spaced by blocking, on minimum 4 in high blocking.
   3. Do not store in a manner that traps excess humidity.
   4. Provide minimum 1/4 in space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Source Limitations: Obtain hollow metal work from single source from single manufacturer.

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008, Designation CS, Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011, Designation CS, Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653, Designation CS, Type B; with minimum A60 metallic coating. Thickness indicated is for uncoated steel.

D. Inserts, Bolts, and Fasteners: Device type and size required, hot-dip galvanized according to ASTM A 153.

E. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.

F. Grout: ASTM C 476, except with maximum slump of 4 in according to ASTM C 143.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6 to 12 lb/cu ft density.

H. Glazing: Comply with Section 08 8000 - Glazing.

I. Primer: Fast-curing, corrosion-inhibiting, lead and chromate free, universal primer complying with ANSI A224.1 acceptance criteria; compatible with substrate and field-applied finish paint system specified in Section 09 9100 - Painting.

J. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing minimum of 94 percent zinc dust by weight.

2.3 FABRICATION, GENERAL

A. Fabrication Quality Standard: ANSI/NAAMM-HMMA 861.

B. General Requirements: Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant.

C. Accessories: Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.

D. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to templates furnished as specified in Section 08 7100 - Door Hardware.

1. Locate hardware according to ANSI/NAAMM-HMMA 861.
2. Reinforce doors and frames to receive non-templated, mortised and surface-mounted door hardware.
3. Comply with applicable requirements in ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.4 HOLLOW METAL DOORS

A. Fabrication Provisions: Fabricate doors not less than 1-3/4 in thick, of seamless hollow construction unless otherwise indicated. Construct doors with smooth surfaces without visible joints or seams on exposed faces.

1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
2. Glazed Lites: Factory cut openings in doors.

B. Exterior Door Face Sheets: Fabricated from metallic-coated steel sheet, minimum 0.0538 in (16 ga) thick.

C. Interior Door Face Sheets: Fabricated from cold-rolled steel sheet, minimum 0.0428 in (18 ga) thick.

D. Core Construction:

1. Steel-Stiffened Core: 0.026 in (22 ga) thick, steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 in apart, spot welded to face sheets a maximum of 5 in on centers. Spaces filled between stiffeners with mineral-fiber insulation.
2. Thermal-Rated (Insulated) Doors: At exterior doors and where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F by h by sq ft/Btu according to ASTM C 518.

E. Vertical Edges:

1. Single Acting Doors: Beveled 1/8 in in 2 in.
2. Double Acting Doors: Round vertical edges with 2-1/8 in radius.

F. Top and Bottom Channels: Closed with continuous channels, minimum 0.0538 in (16 ga) thick, of same material as face sheets and spot welded to both face sheets.

G. Hardware Reinforcement: Fabricate from same material as door. Minimum thickness of steel reinforcing plates for following hardware:

1. Hinges and Pivots: 0.167 in (26 ga) thick by 1-1/2 in wide by 6 in longer than hinge, secured by not less than 6 spot welds.
2. Strikes, Flush Bolts, and Closers: 0.093 in (12 ga).
3. Surface-Mounted Hold-Open Arms and Panic Devices: 0.093 in (12 ga).

2.5 HOLLOW METAL FRAMES

A. Fabrication Provisions:

1. Fabricate frames of construction indicated.
2. Close contact edges of corner joints tight with faces mitered and stops butted or mitered.
3. Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

B. Joinery:

1. Fabrication Quality Standard: Head-to-jamb joints according to ANSI/NAAMM-HMMA

820-08 for either of following fabrication techniques with
   a. Saw-mitered, continuously welded.
   b. Machine-mitered, continuously welded.
2. Externally or internally weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and seamless.
3. Internally weld rabbet and soffits continuously; grind, fill, dress, and make smooth.
4. Use of gusset or splice plates as substitute for welding is not permitted.

C. Materials and Thickness:
1. Door Frames for Exterior Openings: Fabricated from metallic-coated steel sheet, 0.067 in (14 ga) thick.
2. Door Frames for Interior Openings: Fabricated from cold-rolled steel sheet, unless metallic-coated sheet is indicated, of following thicknesses:
   a. 48 in Wide or Less: 0.053 in (16 ga) thick.
   b. More Than 48 in Wide: 0.067 inch (14 ga) thick.
3. Borrowed-Light Frames: Fabricated from 0.053 in (16 ga) thick cold-rolled steel sheet.

D. Stops and Moldings:
1. Form corners with butted or mitered hairline joints.
2. Provide around glazed lites where indicated.
   a. Fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
   b. Loose stops and moldings on inside of hollow metal work so that glass can be removed independently.
3. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

E. Grout Guards: At back of hardware cutouts, install 0.016 in (26 ga) thick grout guards or dust-cover boxes of same material as frame, welded to frame to close off interior of openings and prevent grout or other materials from obstructing hardware operation.

F. Hardware Reinforcement: Fabricate from same material as frame. Minimum thickness of steel reinforcing plates for following hardware:
1. Hinges and Pivots: 0.167 in (26 ga) thick by 1-1/2 in wide by 6 in longer than hinge, secured by not less than 6 spot welds.
2. Strikes, Flush Bolts, and Closers: 0.093 in (12 ga).
3. Surface-Mounted Hold-Open Arms and Panic Devices: 0.093 in.

G. Head Reinforcement: Provide minimum 0.093 in (12 ga) thick, steel channel or angle stiffener for opening widths more than 48 in.

H. Jamb Anchors:
1. Types: Fabricated of same material as frame:
   a. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.0428 in (18 ga) thick.
   b. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.0428 in (18 ga) thick, with corrugated or perforated straps not less than 2 in wide by 10 in long.
2. Quantity and Location:
   a. Stud-Wall Type: Locate anchors not more than 18 in from top and bottom of frame. Space anchors not more than 32 in on centers and as follows:
      1) Three anchors per jamb up to 60 in high.
      2) Four anchors per jamb from 60 to 90 in high.
      3) Five anchors per jamb from 90 to 96 in high.
      4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 in or fraction thereof above 96 in high.
      5) Two anchors per head for frames above 42 in wide and mounted in metal-stud partitions.
   b. Masonry Type: Locate anchors not more than 18 in from top and bottom of frame. Space anchors not more than 32 in on centers and as follows:
      1) Two anchors per jamb up to 60 in high.

2) Three anchors per jamb from 60 to 90 in high.
3) Four anchors per jamb from 90 to 120 in high.
4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 in or fraction thereof above 120 in high.

I. Floor Anchors: Formed from same material as frames welded to bottom of jambs and mullions with not less than 4 spot welds, not less than 0.0428 in (18 ga) thick, and as follows, terminating bottom of frames at finish floor surface:
1. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.
2. Separate Topping Concrete Slabs: Adjustable type anchors with extension clips, allowing not less than 2 in height adjustment.

J. Spreader Bars: Attach two removable metal spreader bars across bottom of frames, tack welded to jambs and mullions.

K. Door Silencers: Except on weatherstripped doors, drill holes to receive door silencers furnished under Section 08 7100 - Door Hardware. Keep holes clear during construction.
1. Single-Door Frames: Strike jamb for 3 door silencers.
2. Double-Door Frames: Head jamb for 2 door silencers.

2.6 STEEL FINISHES

A. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 0.7 mils.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to receive hollow metal and associated Work for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Spreader Bars: Remove welded-in shipping spreaders immediately prior to setting. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Pre-Installation Tolerances: Prior to installation, adjust and securely brace hollow metal frames for squareness, alignment, twist, and plumbness to following:
1. Squareness: Plus or minus 1/16 in, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
2. Alignment: Plus or minus 1/16 in, measured at jambs on a horizontal line parallel to plane of wall.
3. Twist: Plus or minus 1/16 in, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
4. Plumbness: Plus or minus 1/16 in, measured at jambs on a perpendicular line from head to floor.

C. Hardware Preparation: Drill and tap doors and frames to receive non-templated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. ANSI/NAAMM-HMMA 840.
2. Respective manufacturer's written installation instructions.
3. Approved submittals.
4. Contract Documents.

B. Hollow Metal Frames: Install of size and profile indicated.
1. Setting: Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary

braces, leaving surfaces smooth and undamaged.

a. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
b. Install frames with removable glazing stops located on secure side of opening.
c. Install door silencers in frames before grouting.
d. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors or powder actuated fasteners.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Masonry Walls: Solidly fill space between frames and masonry and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
5. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to following:
   a. Squareness: Plus or minus 1/16 in, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
   b. Alignment: Plus or minus 1/16 in, measured at jambs on a horizontal line parallel to plane of wall.
   c. Twist: Plus or minus 1/16 in, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   d. Plumbness: Plus or minus 1/16 in, measured at jambs at floor.

C. Hollow Metal Doors: Provide insulated doors at exterior and non-insulated at interior locations. Fit accurately in frames, within following clearances:
1. Jambs and Head: 1/8 in plus or minus 1/16 in.
2. Between Edges of Pairs of Doors: 1/8 in plus or minus 1/16 in.
3. Between Bottom of Door and Top of Threshold: Maximum 3/8 in.
4. Between Bottom of Door and Top of Finish Floor Covering or Top of Structure (No Threshold): Maximum 3/8 in.

D. Glazing:
1. Comply with installation requirements in Section 08 8000 - Glazing.
2. Secure stops with countersunk flat or oval head machine screws spaced uniformly not more than 9 in on centers and not more than 2 in on centers from each corner.

3.4 ADJUSTMENTS

A. Final Adjustments: Remove and replace defective hollow metal work, including work that is warped, bowed, or otherwise unacceptable.
B. Prime Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of primer compatible with paint specified in Section 09 9100 - Painting.
C. Metallic-Coated Surfaces: Prepare and repair damaged galvanized coatings on fabricated and installed hollow metal work with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 08 1216
KNOCK-DOWN ALUMINUM DOOR FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Interior aluminum knock-down frames for doors and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required; including installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Detailed and dimensioned plans, elevations and large-scale details indicating frame types, profiles, conditions at openings, methods and locations of anchoring, glazing details, and reinforcement for hardware.

C. Samples for Verification: 12 in long of manufacturer's standard door profile showing full range of finish variations expected.

1.3 QUALITY ASSURANCE

A. Source Limitations: Obtain aluminum frames through one source from a single manufacturer with the capacity and resources to provide products of consistent quality in appearance and physical properties.

1.4 WARRANTY

A. Manufacturers Special Warranty: Furnish repair and replacement warranty for 2 years from date of substantial completion agreeing to repair or replace aluminum door frames due to defects, faulty work and failures, including finishing and installation, signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Manufacturer: RACO Interior Products, Inc.
2. Standard and Pocket Door Frame Product: Solutions II, Raco Interior OfficeFronts; 2 inch wide face trim.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B 221, 6063-T5 alloy, or alloy and temper required to maintain color uniformity; not less than 0.062 inch thick.

B. Brackets and Reinforcements: Manufacturer's standard aluminum with non-staining, nonferrous shims for aligning system components.

C. Fasteners and Accessories: Manufacturer's standard non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

1. Reinforce members as required to receive fastener threads.
2. Arrange fasteners, attachments, and jointing to ensure concealment from view. Where required, use exposed fasteners with countersunk Phillips screw heads fabricated from stainless steel.

2.3 FABRICATION

A. General: Fabricate components that, when assembled, have following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

2.4 ALUMINUM FINISH

A. Clear Anodized Aluminum Finish:

1. Finish Quality Standard: AA-M12C22A31 to comply with AAMA 611.
2. Coating: Architectural Class II not less than 0.4 mils thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive interior aluminum door frames and associated Work will be applied for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Install frames plumb and square, free from warp or twist, securely anchored to substrates with fasteners.

C. Maintain dimensional tolerances and alignment with adjacent work.

D. Fit joints to produce hairline joints free of burrs and distortion.

E. Install glazing as specified in appropriate Section 08 8000 - Glazing.

F. Erection Tolerances:
   1. Location and Plane: Limit variation from true location and plane to 1/8 inch in 12 feet; 1/4 inch over total length.
   2. Alignment:
      a. Where surfaces abut in line, limit offset from true alignment to 1/16 inch.
      b. Where surfaces meet at corners, limit offset from true alignment to 1/32 inch.
   3. Diagonal Measurements: Limit difference between diagonal measurement to 1/8 inch.

END OF SECTION

SECTION 08 1416
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Flush wood doors and accessories indicated, specified, or required for installation including, but not limited to, following:
   1. Solid-core doors with faces indicated.
   2. Factory finishing.
   3. Factory fitting to frames and factory machining for hardware.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of door indicated, specified, or required.
   1. Include details of core and edge construction, light frames, and trim for openings.
   2. Include factory-finishing specifications.
   3. Include manufacturer's surface preparation instructions.

B. Shop Drawings: Dimensioned drawings indicating location, size, and hand of each door; elevation of each kind of door; construction details not covered in product data submittal; location and extent of hardware blocking; and other pertinent data.
   1. Indicate dimensions and locations of mortises and holes for hardware.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate requirements for veneer matching.

C. Samples for Verification:
   1. Factory finishes applied to actual door face materials, approximately 8 by 10 in, for each material and finish. For each wood species and transparent finish, provide set of 3 samples showing typical range of color and grain to be expected in
   2. Corner sections of doors, approximately 8 by 10 in, with door faces and edges representing actual materials to be used.
      a. Samples for each species of veneer and solid lumber required.
      b. Samples for each color, texture, and pattern of plastic laminate required.
      c. Finish veneer-faced door samples with same materials proposed for factory-finished doors.

D. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than 5 years experienced in manufacturing products similar to those indicated for this Project with a record of successful in-service performance.

1.4 COORDINATION

A. Interior Architectural Woodwork: Veneer species, cut, matching, and finish of flush wood doors shall be the basis for transparent finished woodwork specified by Section 06 4023 - Interior Architectural Woodwork.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Deliver and install doors only when spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.6 WARRANTY

A. Manufacturers Special Warranty: Furnish repair and replacement warranty for life of installation agreeing to repair or replace flush wood doors due to defects, faulty work and failures, including finishing and installation, signed by an authorized representative using manufacturer's standard form.

B. Defects: Include, but not limited to, following:
   1. Warping (Bow, Cup, or Twist): Not more than 1/4 in in a 42 by 84 in section.
   2. Telegraphing of Core Construction: Not more than 0.01 in in a 3 in span in face veneers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below.
   1. Algoma Hardwoods, Inc.
   2. Eggers Industries.
   3. Graham Manufacturing Corp.
   4. Marshfield Door Systems, Inc.
   5. Mohawk Flush Doors, Inc.; a Masonite Company.
   6. Oshkosh Architectural Door Company.
   7. VT Industries Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Product Quality Standard: In addition to standard listed elsewhere, comply with AWI's "Architectural Woodwork Quality Standards," unless otherwise specified, for construction, finishes, installation, and other requirements:

B. Particleboard Core Doors:
   1. Particleboard: ANSI A208.1, Grade LD-2.
   2. Blocking: Wood blocking as needed to eliminate through-bolting hardware and as follows:
      a. Top Rail: 5 in.
      b. Bottom Rail: 5 in.
      c. Mid Rail: 5 in, in doors indicated to have exit devices.
      d. Lock Blocks: 5 by 10 in, one for lock and two for exit devices.

2.3 VENEERED-FACED DOORS

A. Interior Solid Core Doors:
   1. Grade: Premium, with Grade A wood veneer faces.
   2. Species and Cut Selection: Red oak.
      a. Matching of Adjacent Veneer Leaves: Book.
      b. Assembly of Veneer Leaves on Door Faces: Center-Balance match.
   3. Exposed Vertical Edges: AWI 1300-T-7 #5 Edge, same wood veneer as face veneer with sanded eased edges.
   4. Horizontal Edges: Unfaced, sanded smooth, then apply seal coat.
   5. Core: Particleboard.
   6. Construction: 5 plies.
      a. Stiles and rails bonded to core.
      b. Entire unit abrasive planed before veneering.
      c. Faces bonded to core using a hot press.

2.4 LIGHT FRAMES

A. Wood Beads for Light Openings in Wood Doors:
   1. Description: Manufacturer's standard wood beads and profile. .
   2. Glass: As specified in Section 08 8000 - Glazing.
   3. Material and Finish: Same veneer species and finish as door faces.

2.5 ACCESSORIES

A. Seal Coat: Water-based clear acrylic, VOC compliant, and low odor.

2.6 FABRICATION

A. Fabrication Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified:
   1. DHI-WDHS-3 and DHI A115-W series standards for hardware.
   2. AWI's "Architectural Woodwork Quality Standards."
   3. Approved submittals.
   4. Contract Documents.

B. Factory Fitting: Factory fit doors to suit frame opening sizes indicated according to installation quality standards. Do not trim stiles and rails in excess of limits permitted for fire rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining with seal coat.
   1. Maximum Clearances:

a. Head, Jambs, and Between Pairs of Doors: 1/8 in.
b. Bottom to Top of Floor Coverings: 1/2 in.
c. Bottom to Top of Raised Threshold: 3/8 in.

2. Bevel: 1/8 in in 2 in (3-1/2 deg) at lock and hinge edges; at fire rated doors trim stiles and rails only to extent permitted by labeling agency.

C. Hardware:
1. Factory machine doors for hardware that is not surface applied according to installation quality standards.
2. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
3. Provide built-in 1/4 in diameter raceway through doors, from lockset location to nearest hinge location, for low voltage wiring for doors scheduled to have electric locks.

D. Openings: Cut and trim openings through doors in factory.
1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 8000 - Glazing.
3. Louvers: Factory install louvers in prepared openings.

2.7 TRANSPARENT FINISH

A. General:
1. Comply with referenced quality standard for factory finishing.
2. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
3. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on edges of cutouts and mortises.

B. Grade: Provide finishes of same grades as items to be finished.
C. Transparent Stained Finish: Stain and AWI catalyzed polyurethane.
D. Color: To be selected.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to receive flush wood doors and associated work to which flush wood doors will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

B. Verifications:
1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
1. AWI's "Architectural Woodwork Quality Standards."
2. Respective manufacturer's written installation instructions.
3. Approved submittals.
4. Contract Documents.

B. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
C. Hardware: As specified in Section 08 7100 - Door Hardware.
D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.
B. Finished Doors: Replace doors that are damaged or that do not comply with requirements.

Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 08 3113
ACCESS DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Access doors in walls, floors, and ceilings, and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include construction details, materials, individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified under each item below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into Work include, but are not limited to, those listed alphabetically below.

1. Acudor Products, Inc.
2. Babcock-Davis; A Cierra Products Co.
3. J. L. Industries, Inc.
4. Karp Associates, Inc.
5. Larsen's Manufacturing Company.
6. Milcor Inc.
7. Nystrom, Inc.
8. Williams Bros., The Corporation of America.

2.2 STEEL MATERIALS

A. Steel Sheet: Uncoated cold-rolled steel sheet substrate complying with ASTM A 1008, Commercial Steel (CS), exposed.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

C. Drywall Beads: Edge trim formed from 0.0299 in zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

2.3 STAINLESS STEEL MATERIALS

A. Stainless Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304, directional satin No. 4 finish. Remove tool and die marks and stretch lines or blend into finish.

2.4 ACCESS DOORS

A. Flush Access Doors with Exposed Trim: Fabricated from stainless steel sheet.

1. Locations: Masonry and ceramic tile wall surfaces.
2. Door: Minimum 0.060 in thick sheet metal, set flush with exposed face flange of frame.
3. Frame: Minimum 0.060 in thick sheet metal with 1-1/4 in wide, surface-mounted trim.
4. Hinges: Continuous piano.
5. Lock: Cylinder.
6. Basis of Design:
   a. Manufacturer: Nystrom Building Products.
   b. Product: Model NW or NP as applicable.

B. Flush Access Doors and Trimless Frames: Fabricated from steel or stainless-steel sheet according to schedule at end of Part 3.

1. Locations: Gypsum board wall and ceiling surfaces.
2. Door: Minimum 0.075 in thick sheet metal, set flush with surrounding finish surfaces.
3. Frame: Minimum 0.060 in thick sheet metal with drywall bead flange.
4. Hinges: Continuous piano.
5. Lock: Cylinder.
6. Basis of Design:
   a. Manufacturer: Nystrom Building Products.
   b. Product: Model RW or RP as applicable.

2.5 FABRICATION

A. General: Provide access door assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces 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.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.
   1. For trimless frames with drywall bead, provide edge trim for gypsum board securely attached to perimeter of frames.
   2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
   3. Provide mounting holes in frames for attachment of units to metal framing.
   4. Provide mounting holes in frame for attachment of masonry anchors.

D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.

E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
   1. For cylinder lock, furnish two keys per lock and key all locks alike.
   2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive access doors and associated Work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Advise installers of other work about specific requirements relating to access door installation, including sizes of openings to receive access door, as well as locations of supports, inserts, and anchoring devices.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Set access doors accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.4 ADJUSTING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors that are warped, bowed, or otherwise damaged.

3.5 SCHEDULE

A. Provide access doors, where indicated on drawings, and where scheduled below:
   1. Provide access doors at concealed valves and controls for plumbing and HVAC.
   2. Provide stainless steel access doors at exterior locations.
   3. Provide stainless steel access doors at ceramic tile and other damp locations.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 08 3326
OVERHEAD COILING GRILLE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Open-curtain overhead coiling grille and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each overhead coiling grille. Include the following:
   1. Construction details, material descriptions, dimensions of individual components, profiles for curtain components, and finishes.
   2. Rated capacities, operating characteristics, electrical characteristics, and furnished accessories.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Wiring Diagrams: For power, signal, and control wiring.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for both installation and maintenance of units required for this Project.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
   1. Manufacturer: Clopay Building Products.
   2. Model Number: CESG10.

2.2 GRILLE CURTAIN MATERIALS AND CONSTRUCTION

A. Open-Curtain Grilles: Fabricate metal grille curtain as an open network of horizontal rods, spaced at regular intervals, that are interconnected with vertical links, which are formed and spaced as indicated and are free to rotate on the rods.
   1. Aluminum Grille Curtain: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Endlocks: Continuous end links, chains, or other devices at ends of rods; locking and retaining grille curtain in guides against excessive pressures, maintaining grille curtain alignment, and preventing lateral movement.

C. Bottom Bar: Manufacturer's standard continuous channel or tubular shape, finished to match grille equipped with a replaceable, adjustable, continuous, compressible gasket of flexible vinyl, rubber, or neoprene as a cushion bumper.

D. Grille Curtain Jamb Guides: Manufacturer's standard shape having curtain groove with return lips or bars to retain curtain. Provide continuous integral wear strips to prevent metal-to-metal contact and to minimize operational noise; with removable stops on guides to prevent overtravel of curtain.

2.3 HOODS AND ACCESSORIES

A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.

1. Aluminum: 0.040 inch thick aluminum sheet complying with ASTM B 209, of alloy and temper recommended by manufacturer and finisher for type of use and finish indicated.

B. Mounting Frame: Manufacturer's standard mounting frame designed to support grille; factory fabricated from ASTM A 36 structural-steel tubes or shapes; to be built into wall construction; and complete with anchors, connections, and fasteners.

2.4 COUNTERBALANCING MECHANISM

A. General: Counterbalance grilles by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, welded or seamless carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of parts and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.

C. Spring Balance: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.

D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.

E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.5 ELECTRIC GRILLE OPERATORS

A. General: Electric grille operator assembly of size and capacity recommended and provided by grille manufacturer for grille and operation-cycles requirement specified, with electric motor and factory-prewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, remote-control stations, control devices, integral gearing for locking grille, and accessories required for proper operation.

1. Comply with NFPA 70.
2. Provide control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24 V, ac or dc.

B. Grille Operator Location: Operator location indicated for each grille.

1. Top-of-Hood Mounted: Operator is mounted to the right or left grille head plate with the operator on top of the grille-hood assembly and connected to the grille drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.

C. Electric Motors: Provide high-starting torque, reversible, continuous-duty, Class A insulated, electric motors, complying with NEMA MG 1, with overload protection, sized to start, accelerate, and operate grille in either direction, from any position, at not less than 2/3 fps and not more than 1 fps, without exceeding nameplate ratings or considering service factor.

1. Type: Polyphase, medium-induction type.
2. Service Factor: According to NEMA MG 1, unless otherwise indicated.
3. Coordinate wiring requirements and electric characteristics of motors with building electrical system.
4. Provide open dripproof-type motor, and controller with NEMA ICS 6, Type 1 enclosure.
5. Provide totally enclosed, nonventilated or fan-cooled motors, fitted with plugged drain, and controller with NEMA ICS 6, Type 4 enclosure for exterior location.
6. Operating Controls, Controllers (Disconnect Switches), Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
7. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.

D. Limit Switches: Equip each motorized grille with adjustable switches interlocked with motor controls and set to automatically stop grille at fully opened and fully closed positions.

E. Obstruction Detection Device: Equip motorized grille with indicated external automatic safety sensor capable of protecting full width of grille opening. Activation of sensor immediately stops and reverses downward grille travel.

1. Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
    a. Self-Monitoring Type: Four-wire configured device designed to interface with grille operator control circuit to detect damage to or disconnection of sensing device.

F. Remote-Control Station: Momentary-contact, three-button control station with push-button controls labeled "Open," "Close," and "Stop."

G. Emergency Manual Operation: Equip each electrically powered grille with capability for emergency manual operation. Design manual mechanism so required force for grille operation does not exceed 25 lbf.

H. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.

I. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.

2.6 ALUMINUM FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Baked-Enamel or Powder-Coat Finish: AAMA 2603. Comply with coating manufacturer's written instructions for cleaning, conversion coating, application, and baking.
    1. Color and Gloss: As selected by Architect from manufacturer's full range of colors and glosses.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.

B. Examine locations of electrical connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install overhead coiling grilles and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.

3.3 ADJUSTING

A. Adjust hardware and moving parts to function smoothly so that grilles operate easily, free of warp, twist, or distortion.

B. Lubricate bearings and sliding parts as recommended by manufacturer.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 08 4113
ALUMINUM FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior glazed aluminum framed storefronts, exterior and interior entrance doors, and accessories indicated, specified, or required for installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Contract Document Concept: Drawings and Specifications express concept of aluminum framed entrances and storefront work, however, they may not indicate or specify total work that may be required, nor shall they be construed as engineered.

B. Delegated Engineering Responsibility: Require aluminum framed entrances and storefront manufacturer to employ a delegated engineering professional to provide engineering for each member and component of aluminum framed entrances and storefronts, including attachment to building structural frame, required to meet concept expressed in Contract Documents that includes, but is not limited to, following:

1. Comprehensive engineering analysis indicating location, type, magnitude, and direction of loads imposed on building structural frame.
2. Preparation of engineering calculations, shop drawings, and other submittals with professional seal affixed according to respective jurisdictional licensing regulations.

C. Coordination of Contract Documents and Work:

1. Product Differences: Owner and Architect recognize there are minor differences between products of manufacturers. To resolve potential conflicts between Contract Documents and execution of Work in a timely manner, identify constructability issues and notify Architect. Absence of notice constitutes acceptance of conditions indicated, and changes caused by minor differences between delegated engineering and Contract Documents will be at no additional cost to Owner.
2. Allowable Adjustments: Minor adjustments may be made in interest of fabrication, erection methods, techniques, or ability to satisfy concept expressed in Contract Documents, provided concept is maintained as determined by Architect. Proposed deviations shall include a detailed analysis of impact to adjacent substrates or other building systems, including additional costs.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Requirements: Withstand movements of supporting structure including, but not limited to, wind load, and deflection from uniformly distributed and concentrated live loads.

B. Wind Resistance Criteria: Withstand load effects of 150 percent of inward positive and outward negative design wind load design pressures, as indicated in Contract Documents, acting inward and outward normal to plane of wall according to ASTM E 330.

C. Deflection of Framing Members: At design wind pressure, as follows:

1. Deflection Normal to Wall Plane: Limited to edge of glass in a direction perpendicular to glass plane not exceeding L/175 of the glass edge length for each individual glazing lite or an amount that restricts edge deflection of individual glazing lites to 3/4 in, whichever is less.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 in.
3. Cantilever Deflection: Where framing members overhang an anchor point, limit deflection to 2 times the length of cantilevered member divided by 175.
4. The center deflection of the window stool trim, when subjected to a 250 pound vertical concentrated load, shall not exceed 1/8 in.

D. Air Infiltration Resistance Criteria: Withstand not more than 0.06 cfm/sq ft of fixed area at static air pressure differential not less than 6.24 ft lbs/sq ft according to ASTM E 283.

E. Water Penetration under Static Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-

pressure differential of 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq ft.

F. Water Penetration under Dynamic Pressure: No evidence of water penetration through fixed glazing and framing areas when tested according to AAMA 501.1 at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 10 lbf/sq ft.

G. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Interior Ambient-Air Temperature: 75 deg F.
   3. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.

1.4 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Detailed and dimensioned plans, elevations, sections, and large-scale details prepared by manufacturer, not fabricator. Show adaptation of manufacturer's standard aluminum framed entrances and storefronts to project; include attachments to other work.
   1. Include details for assembly expansion and contraction.
   2. Indicate where and how the system deviates from Contract Documents.
   3. Include seal of a professional engineer.
   4. Include details of how wall will accommodate infiltrated and condensate water.
   5. Include vertical-to-horizontal intersection framing, including, but not limited to, following:
      a. Joinery, including concealed welds.
      b. Anchorage.
      c. Expansion provisions.
      d. Glazing.
      e. Flashing and drainage.

C. Samples for Verification: 12 in long section of aluminum extrusions or formed shapes for each type of exposed finish required.

D. Delegated Engineering Calculations: Engineering calculations, sealed by delegated engineering professional, for portion of Work designated as delegated engineering. Test reports not acceptable substitute for calculations.

E. Manufacturer's Field Reports: Submit detailed report of visits made by representatives of the manufacturer to the Project as specified in "Field Quality Control" Article.

F. Maintenance Data: For inclusion in operation and maintenance manual required by Section 01 7700 – Closeout Procedures.
   1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
   2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.
   3. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Experience: Company with not less than 10 years experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
   2. Supervision: Maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

B. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering

services of kind indicated that have resulted in installations of aluminum framed entrances and storefronts similar to this Project, and, that has a record of successful in-service performance.

C. Accessibility Requirements: Comply with Americans with Disabilities Act (ADA), ANSI A 117.1, and accessibility standards required by authorities having jurisdiction.

1.6 WARRANTY

A. Special Manufacturers Warranty:
   1. Warranty: Standard form in which manufacturer agrees to repair or replace components of aluminum framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within 5 years from date of substantial completion.
   2. Failures: Include, but not limited to, following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration created by wind and thermal and structural movements.
      c. Deterioration of metals and other materials beyond normal weathering.
      d. Water penetration through fixed glazing and framing areas.
      e. Failure of operating components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
   1. Manufacturer: Kawneer North America; an Alcoa Company.
   2. Acceptable Products:
      a. Window Frame Style: TRIFAB VG 451T Framing System; Thermal break; Center Glazed; Screw Spline Fabrication.
      b. Door Style: Type 500 Door; wide stile.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below.
   1. Kawneer North America; an Alcoa Company.
   2. OldcastleBuildingEnvelope.
   3. United States Aluminum Corp.
   4. YKK AP America Inc.

2.2 MATERIALS

A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
   1. Sheet and Plate: ASTM B 209.
   2. Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.
   3. Extruded Structural Pipe and Tubes: ASTM B 429.
   4. Structural Profiles: ASTM B 308.

2.3 FRAMING

A. Framing Members: Manufacturer's standard formed- or extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.

B. Fasteners: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding device, type, and size required, sufficient to correctly attach or anchor specified item to substrate indicated without failure; compatible with adjacent materials.
   1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
   2. Reinforce members as required to receive fastener threads.
   3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.

C. Anchors: Three-way adjustable anchors that accommodate fabrication and installation tolerances in material and finish and are compatible with adjoining materials and recommended by manufacturer.

D. Concealed Flashing: Dead-soft, 0.018 in thick stainless steel, ASTM A 240 of type recommended by manufacturer.

2.4 ENTRANCE DOORS

A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing operation.
   1. Door Construction: 1-3/4 inch overall thickness, with minimum 0.125 inch thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded.
   2. Door Design: As indicated.
   3. Glazing Stops: Square, snap-on, extruded-aluminum stops; non-removable glazing stops on outside of door.

B. Entrance Door Hardware: As specified in appropriate Section 08 7100 - Door Hardware.

2.5 GLAZING

A. Glazing: As specified in Section 08 8000 - Glazing.

2.6 FABRICATION

A. Shop Fabrication: Fabricate aluminum extrusion framing that, when assembled, have following characteristics:
   1. Form or extrude aluminum shapes before finishing.
   2. Straight, sharp profiles, and free of defects or deformations.
   3. Accurately fitted joints with ends coped or mitered.
   4. Physical and thermal isolation of glazing from framing members.
   5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
   6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
   7. Provisions for field replacement of glazing.
   8. Internal guttering systems or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within wall to exterior.

B. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
   1. At exterior doors, provide compression weatherstripping at fixed stops.
   2. At interior doors, provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

C. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
   1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
   2. At exterior doors, provide weather sweeps applied to door bottoms.

D. Entrance Door Hardware: Cut, drill, and tap for hardware before applying finishes.

2.7 ALUMINUM FINISHES

A. Finish Quality Standards: In addition to standards specified elsewhere, perform work according to following, unless otherwise specified:
   1. NAAMM's Metal Finishes Manual.
   2. AA's DAF-45 Designation Systems for Aluminum Finishes.
   3. Approved submittals.
   4. Contract Documents.

B. Protection of Finish: Protect exposed surfaces from damage by applying a strippable, temporary protective covering prior to shipment.

C. Appearance of Finished Work:
   1. Variations in appearance of abutting or adjacent pieces are acceptable if they are within one half of range of approved submittal samples.
   2. Noticeable variations in same piece are not acceptable.
   3. Variations in appearance of other components are acceptable if they are within range of approved submittal samples and they are assembled or installed to minimize contrast as determined by Architect.

D. Dark Bronze Anodized Aluminum Finish:
   1. Finish Quality Standard: AA-M12C22A42/A44 to comply with AAMA 611
   2. Coating: Architectural Class I not less than 0.7 mils (0.0178 mm) thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive aluminum framed entrances and storefront and associated work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. General Requirements:
   1. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
   2. Fit joints to produce hairline joints free of burrs and distortion.
   3. Rigidly secure non-moving joints.
   4. Install anchors with separators and isolators to prevent metal corrosion, electrolytic deterioration, and impediments to movement of joints.
   5. Seal joints watertight unless otherwise indicated.
   6. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within wall to exterior.

C. Glazing: Install as specified in appropriate Section 08 8000 - Glazing.

D. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
   1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
   2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

E. Erection Tolerances: Install to comply with the following non-accumulating maximum tolerances:
   1. Plumb: 1/8 in in 10 ft; 1/4 in in 40 ft.
   2. Level: 1/8 in in 20 ft; 1/4 in in 40 ft.
   3. Alignment:
      a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 in wide, limit offset from true alignment to 1/16 in.
      b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 in wide, limit offset from true alignment to 1/8 in.
      c. Where surfaces are separated by reveal or protruding element of 1 in wide or more, limit offset from true alignment to 1/4 in.
   4. Location: Limit variation from plane to 1/8 in in 12 ft; 1/2 in over total length.

3.3 FIELD QUALITY CONTROL

A. Manufacturers Field Inspection: Manufacturers technical representative shall inspect first days Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings and conclusions of inspection.

B. Water Testing Services: Test representative areas of wall areas designated by Architect shall as installation proceeds according to AAMA 501.2 to determine compliance of installed assemblies with specified requirements.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 08 7100
DOOR HARDWARE

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 commercial door hardware for the following:
   1. Swinging doors.
   2. Sliding doors.
   3. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:
   1. Mechanical door hardware.
   2. Cylinders specified for doors in other sections.

C. Related Sections:
   1. Division 01 Section "Sustainable Design Requirements" for additional LEED documentation and requirements.
   2. Division 08 Section “Door Hardware Schedule”.
   3. Division 08 Section “Hollow Metal Doors and Frames”.
   4. Division 08 Section “Interior Aluminum Doors and Frames”.
   5. Division 08 Section “Flush Wood Doors”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
   1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
   2. ICC/IBC - International Building Code.
   3. NFPA 80 - Fire Doors and Windows.
   4. NFPA 101 - Life Safety Code.
   5. NFPA 105 - Installation of Smoke Door Assemblies.
   6. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards:
   1. ANSI/BHMA Certified Product Standards - A156 Series
   2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
   2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
   3. Content: Include the following information:
      a. Type, style, function, size, label, hand, and finish of each door hardware item.
      b. Manufacturer of each item.
      c. Fastenings and other pertinent information.
      d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.

e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:
1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
2. Electrical Coordination: Coordinate with related Division 26 Electrical Sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives. The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in this Section.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum 3 years documented experience installing both standard and electrified builders hardware 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.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

D. Source Limitations: Obtain each type and variety of Door Hardware specified in this Section from a single source, qualified supplier unless otherwise indicated.
1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

E. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the model building code including, but not limited to, the following:
   1. NFPA 70 "National Electrical Code", including electrical components, devices, and accessories listed and labeled as defined in Article 100 by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
   2. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," ANSI A117.1 as follows:
      a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
      b. Door Closers: Comply with the following maximum opening-force requirements indicated:
         1) Interior Hinged Doors: 5 lbf applied perpendicular to door.
         2) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
      c. Thresholds: Not more than 1/2 inch high. Bevel raised thresholds with a slope of not more than 1:2.
   3. NFPA 101: Comply with the following for means of egress doors:
      a. Latches, Locks, and Exit Devices: Not more than 15 lbf to release the latch. Locks shall not require the use of a key, tool, or special knowledge for operation.
      b. Thresholds: Not more than 1/2 inch high.
   4. Fire-Rated Door Assemblies: Provide door hardware for 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 252 (neutral pressure at 40" above sill) or UL-10C.
      a. Test Pressure: Positive pressure labeling.

F. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
   1. Function of building, purpose of each area and degree of security required.
   2. Plans for existing and future key system expansion.
   3. Requirements for key control storage and software.
   4. Installation of permanent keys, cylinder cores and software.
   5. Address and requirements for delivery of keys.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
   1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
   2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
   3. Review sequence of operation narratives for each unique access controlled opening.
   4. Review and finalize construction schedule and verify availability of materials.

5. Review the required inspecting, testing, commissioning, and demonstration procedures

I. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Related Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual surface door closers.
4. Ten years for heavy duty floor closers.
5. Two years for shallow depth floor closers.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Continuing Service: Beginning at Substantial Completion, and running concurrent with the specified warranty period, provide continuous (6) months full maintenance including repair and replacement of worn or defective components, lubrication, cleaning, and adjusting as required

for proper door opening operation. Provide parts and supplies as used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

1. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
   a. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

B. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 MATERIALS

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than the following:

1. Floor Closers: 63%
2. Pivots: 78%
3. Cylindrical Locks: 58%
4. Mortise Locks: 57%
5. Exit Devices: 54%
6. Door Closers: 51%
7. Overhead Stops: 46%

2.3 HANGING DEVICES

A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
   a. Two Hinges: For doors with heights up to 60 inches.
   b. Three Hinges: For doors with heights 61 to 90 inches.
   c. Four Hinges: For doors with heights 91 to 120 inches.
   d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
   b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
   a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
   b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
   a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
      1) Out-swinging exterior doors.
      2) Out-swinging access controlled doors.

3) Out-swinging lockable doors.

5. Acceptable Manufacturers:
   a. Hager Companies (HA).
   b. McKinney Products (MK).

B. Continuous Geared Hinges: ANSI/BHMA A156.26 certified continuous geared hinge with minimum 0.120-inch thick extruded 6060 T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Provide concealed flush mount (with or without inset), full surface, or half surface, in standard and heavy duty models, as specified in the Hardware Sets. Concealed continuous hinges to be U.L. listed for use on up to and including 90 minute rated door installations and U.L. listed for windstorm components where applicable. Factory cut hinges for door size and provide with removable service power transfer panel where indicated at electrified openings.

1. Acceptable Manufacturers:
   a. McKinney Products (MK).
   b. Pemko Manufacturing (PE).

C. Floor Closers: ANSI/BHMA A156.4 certified floor closers provided either center hung or 3/4" offset hung type complete with top and intermediate pivots (offset closers only) in quantity according to manufacturer's recommendation. Floor closers available with options for labeled, lead lined and regular doors. Provide independent and adjustable valves for closing speed, latch speed, and backcheck with built-in dead stop and hold open features as specified. Provide finish cover plates or thresholds as indicated in door Hardware Sets.

1. Acceptable Manufacturers:
   a. Rixson Door Controls (RF).

D. Pivots: ANSI/BHMA A156.4, Grade 1, certified pivots provided either center hung or 3/4" offset type complete with top, bottom, and intermediate pivots (offset pivots only) in quantity according to manufacturer's recommendations. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Acceptable Manufacturers:
   a. Rixson Door Controls (RF).

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified automatic, self-latching, and manual flush bolts and surface bolts. Manual flush bolts to be furnished with top rod of sufficient length to allow bolt location approximately six feet from the floor. Furnish dust proof strikes for bottom bolts. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

1. Acceptable Manufacturers:
   a. Rockwood Manufacturing (RO).
   b. Trimco (TC).

B. Door Push Plates and Pulls: ANS/BHMA A156.6 certified door pushes and pulls of type and design specified below or in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.

4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
    a. Acceptable Manufacturers:
        1) Rockwood Manufacturing (RO).
        2) Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

C. Cylinders: Original manufacturer cylinders complying with the following:
1. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
5. Keyway: Manufacturer's Standard.

D. Patented Cylinders: ANSI/BHMA A156.5, Grade 1, certified cylinders employing a utility patented and restricted keyway requiring the use of patented controlled keys. Provide bump resistant, fixed core cylinders as standard with solid recessed cylinder collars. Cylinders are to be factory keyed where permanent keying records will be established and maintained.
1. Provide a 6 pin multi-level master key system comprised of patented controlled keys and security and high security cylinders operated by one (1) key of the highest level. Geographical exclusivity to be provided for all security and high security cylinders and UL437 certification where specified.
    a. Level 1 Cylinders: Provide utility patented controlled keyway cylinders that are furnished with patented keys available only from authorized distribution.
    b. Level 2 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders constructed to provide protection against bumping and picking.
    c. Level 3 Cylinders: Provide utility patented controlled keyway and side bar locking incorporating unique angled bottom pins for geographical exclusivity. Cylinders to be UL437 certified and constructed to provide protection against bumping, picking, and drilling.
    d. Refer to hardware sets for specified levels.
2. Acceptable Manufacturer:
    a. Sargent Manufacturing (SA) - Degree Series.
    b. Corbin Russwin (RU) – Access 3 Series.

E. Keying System: Each type of lock and cylinders to be factory keyed. Conduct specified "Keying Conference" to define and document keying system instructions and requirements. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner. Incorporate decisions made in keying conference, and as follows:
1. Master Key System: Cylinders are operated by a change key and a master key.
2. Grand Master Key System: Cylinders are operated by a change key, a master key, and a grand master key.
3. Great-Grand Master Key System: Cylinders are operated by a change key, a master key, a grand master key, and a great-grand master key.
4. Existing System: Master key or grand master key locks to Owner's existing system.
5. Keyed Alike: Key all cylinders to same change key.

F. Key Quantity: Provide the following minimum number of keys:
1. Top Master Key: One (1)
2. Change Keys per Cylinder: Two (2)
3. Master Keys (per Master Key Group): Two (2)

4. Grand Master Keys (per Grand Master Key Group): Two (2)
5. Construction Keys (where required): Ten (10)
6. Construction Control Keys (where required): Two (2)
7. Permanent Control Keys (where required): Two (2)

G. Construction Keying: Provide construction master keyed cylinders or temporary keyed construction cores where specified. Provide construction master keys in quantity as required by project Contractor. Replace construction cores with permanent cores. Furnish permanent cores for installation as directed under specified "Keying Conference".

H. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Acceptable Manufacturers:
   a. Lund Equipment (LU).
   b. MMF Industries (MM).
   c. Telkee (TK).

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified mortise locksets furnished in the functions as specified in the Hardware Sets. Locksets to be manufactured with a corrosion resistant, stamped 12 gauge minimum formed steel case and be field-reversible for handing without disassembly of the lock body. Lockset trim (including knobs, levers, escutcheons, roses) to be the product of a single manufacturer. Furnish with standard 2 3/4" backset, 3/4" throw anti-friction stainless steel latchbolt, and a full 1" throw stainless steel bolt for deadbolt functions.

1. Acceptable Manufacturers:
   a. Corbin Russwin Hardware (RU) – ML2000 Series.
   b. Sargent Manufacturing (SA) – 8200 Series.
   c. Schlage (SC) – L9000 Series.
   d. Yale Locks and Hardware (YA) – 8800FL Series.

B. Lock Trim Design: As specified in Hardware Sets.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.

2.8 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the

proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.

a. Fire Exit Removable Mullions: Provide keyed removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UL 305 and NFPA 252. Mullions to be used only with exit devices for which they have been tested.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is not acceptable except in any case where the door light extends behind the device as in a full glass configuration.
5. Flush End Caps: Provide heavy weight impact resistant flush end caps made of architectural metal in the same finish as the devices as in the Hardware Sets. Plastic end caps will not be acceptable.
6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty trim with cold forged escutcheons, beveled edges, and four threaded studs for thru-bolts.
   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets. Provided free-wheeling type trim where indicated.
   b. Where function of exit device requires a cylinder, provide an interchangeable core type keyed cylinder (Rim or Mortise) as specified in Hardware Sets.
7. Vertical Rod Exit Devices: Provide and install interior surface and concealed vertical rod exit devices as Less Bottom Rod (LBR) unless otherwise indicated.
8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Mounting rails to be formed from smooth stainless steel, brass or bronze architectural materials no less than 0.072" thick, with push rails a minimum of 0.062" thickness. Painted or aluminum metal rails are not acceptable. Exit device latch to be investment cast stainless steel, pullman type, with deadlock feature.

1. Acceptable Manufacturers:
   a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
   b. Sargent Manufacturing (SA) - 80 Series.
   c. Von Duprin (VD) - 35A/98 XP Series.

C. Tube Steel Removable Mullions: ANSI/BHMA A156.3 removable steel mullions with malleable-iron top and bottom retainers and a primed paint finish. Provide keyed removable feature, stabilizers, and mounting brackets as specified in the Hardware Sets. At openings designed for severe wind load conditions due to hurricanes or tornadoes, provide manufacturers approved mullion and accessories to meet applicable state and local windstorm codes.

1. Acceptable Manufacturers:
   a. Corbin Russwin Hardware (RU) - 700/900 Series.
   b. Sargent Manufacturing (SA) - 980S Series.
   c. Von Duprin (VD) - 9954 Series.

2.9 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size.

Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.

2. Standards: Closers to comply with UL-10C and UBC 7-2 for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
    a. Where closers are indicated to have mechanical dead-stop, provide heavy duty arms and brackets with an integral positive stop.
    b. Where closers are indicated to have mechanical hold open, provide heavy duty units with an additional built-in mechanical holder assembly designed to hold open against normal wind and traffic conditions. Holder to be manually selectable to on-off position.
    c. Where closers are indicated to have a cushion-type stop, provide heavy duty arms and brackets with spring stop mechanism to cushion door when opened to maximum degree.
    d. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics. Provide drop plates or other accessories as required for proper mounting.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates, and through-bolt or security type fasteners as specified in the door Hardware Sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
    1. Acceptable Manufacturers:
        a. Corbin Russwin Hardware (RU) - DC8000 Series.
        b. LCN Closers (LC) - 4040XP Series.
        c. Sargent Manufacturing (SA) - 351 Series.
        d. Norton Door Controls (NO) - 7500 Series.
        e. Yale Locks and Hardware (YA) - 4400 Series.

C. Door Closers, Surface Mounted (Commercial Duty): ANSI/BHMA 156.4, Grade 1 certified surface mounted, institutional grade door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck, closing sweep, and latch speed control valves. Provide non-handed units standard.
    1. Acceptable Manufacturers:
        a. Corbin Russwin Hardware (RU) - DC6000 Series.
        b. LCN Closers (LC) - 1460FC Series.
        c. Norton Door Controls (NO) - 8500 Series.
        d. Sargent Manufacturing (SA) - 1431 Series.
        e. Yale Locks and Hardware (YA) - 3500 Series.

2.10 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Metal Protection Plates: ANSI/BHMA A156.6 certified metal protection plates (kick, armor, or mop), beveled on four edges (B4E), fabricated from the following:
    a. Stainless Steel: 300 series, 050-inch thick, with countersunk screw holes (CSK).
    b. Brass or Bronze: 050-inch thick, with countersunk screw holes (CSK).
    c. Laminate Plastic or Acrylic: 1/8-inch thick, with countersunk screw holes (CSK).
4. Fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets.
5. Metal Door Edging: Door protection edging fabricated from a minimum .050-inch thick metal sheet, formed into an angle or "U" cap shapes, surface or mortised mounted onto edge of door. Provide appropriate leg overlap to account for protection plates as required. Height to be as specified in the Hardware Sets.
6. Acceptable Manufacturers:
    a. Rockwood Manufacturing (RO).

2.11 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
    1. Acceptable Manufacturers:
        a. Rockwood Manufacturing (RO).
        b. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
    1. Acceptable Manufacturers:
        a. Rixson Door Controls (RF).
        b. Rockwood Manufacturing (RO).
        c. Sargent Manufacturing (SA).

2.12 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
    1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: 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 UL-10C.
    1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and UBC 7-2, Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Acceptable Manufacturers:
   1. Pemko Manufacturing (PE).
   2. Reese Enterprises, Inc. (RS).

2.13 ELECTRONIC ACCESSORIES

A. Wireless Card Readers: Card readers to support HID 125 kHz proximity technology or 13.56 MHz contactless smart cards as specified in the hardware sets. Card readers to meet the following minimum design and performance specifications.
   1. Reader to wirelessly operate on one 3V CR2 lithium battery.
   2. Reader to be suitable for outdoor use.
   3. Contactless smart card versions to be compatible with the following technologies: iCLASS, iCLASS Seos, iCLASS SE, ISO1443B UID, Mifare, Mifare Plus, Desfire SE, Desfire EV1, NFC
   4. Reader to come pre-paired with an Aperio hub and communicate with the hub via IEEE802.14.4 (2.4 GHz) wireless technology.
   5. Aperio hub to communicate with the access control panel using industry standard Wiegand protocol interface.
   6. Reader to have green LED status indicator.
   7. Reader type and model to meet the design and mounting applications needs of each entry point as indicated on the drawings.
   8. Acceptable Manufacturers:
      a. Securitron (SU) – R100 Series.

B. Integrated Wiegand Digital Keypads: Digital keypad designed for high volume use controlling entry of electrified locking devices. Fully weather proof, vandal resistant with wall type gang box or mullion mounting applications. Keypad provides Wiegand output for integration into access control system. Provide DKC Digital Controllers to complete the installation of the keypads.
   1. Acceptable Manufacturers:
      a. Securitron (SU) – DK-37/DK-38 Series.

C. Touchless Switches: FCC certified microwave sensing switch used for REX or activation of various access control devices in place of a traditional wired switch. Unit to have an adjustable sensing zone from 4” to 24”. At exterior locations furnish foam gaskets and weather covers. Provide single gang or double gang unit as specified in the hardware sets
   1. Acceptable Manufacturers:
      a. Securitron (SU) - WSS Series.

D. Power Supplies: Provide Nationally Recognized Testing Laboratory Listed 12VDC or 24VDC (field selectable) filtered and regulated power supplies. Include battery backup option with integral battery charging capability in addition to operating the DC load in event of line voltage failure. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
   1. Acceptable Manufacturers:
      a. Securitron (SU) - BPS Series.

2.14 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.15 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. and provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Refer to Section 080671, Door Hardware Schedule, for hardware sets.

C. Manufacturer’s Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RF - Rixson
4. RO - Rockwood
5. SA - Sargent
6. AD - Adams Rite
7. 00 - Other
8. HS - HES
9. NO - Norton
10. SU - Securitron

Hardware Schedule

Set: 1.0

Doors: 100

2	Pivot	M19	626	RF
1	Exit Device	AD8410 106 x 863	US32D	SA
1	Exit Device	AD8410 863	US32D	SA
1	Cylinder	DG1-63-42	US26D	SA
2	Floor Closer	27N 90 LFP	626	RF
1	Threshold	171A		PE
2	Sweep	18062CNB		PE

Set: 2.0

Doors: 101

1	Pivot	EM19	626	RF
1	Pivot	M19	626	RF
1	Electric Exit Device	AD8474-24v ETL	US32D	SA
1	Exit Device	AD8410	US32D	SA
2	Floor Closer	27N 90 LFP	626	RF
1	ElectroLynx Harness	QC-C006		MK
1	ElectroLynx Harness	QC-C1500		MK
1	Power Supply	By Security Vendor		00
1	Card Reader	By Security Vendor		00
1	DPS	By Security Vendor		00

Set: 3.0

Doors: 108A, 137A

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Exit Device (rim, nightlatch)	DG1 63 8804 863	US32D	SA
1	Electric Strike	9400	630	HS
1	Door Closer	CLP7500 SN-134	689	NO
1	Threshold	171A		PE
1	Gasketing	315CN		PE
1	Gasketing	332CR		PE
1	Power Supply	By Security Vendor		00
1	Card Reader	By Security Vendor		00
1	DPS	By Security Vendor		00

Set: 4.0

Doors: 105A

2	Continuous Hinge	CFM__SLF-HD1 Ht Required		PE
1	Removable Mullion	L980	PC	SA
2	Exit Device (rim, nightlatch)	DG1 63 8804 863	US32D	SA
2	Cylinder	DG1-63-42	US26D	SA
1	Electric Strike	9400	630	HS
2	Door Closer	CLP7500 SN-134	689	NO
1	Threshold	171A		PE
1	Gasketing	315CN		PE
1	Gasketing	332CR		PE
1	ElectroLynx Harness	QC-C006		MK
1	ElectroLynx Harness	QC-C1500		MK
1	Power Supply	By Security Vendor		00

1 Card Reader	By Security Vendor		00
1 DPS	By Security Vendor		00

Set: 5.0

Doors: 106, 112, 113, 114, 115, 118, 128, 132

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Office Lock	DG1 8205 COMI	US26D	SA
1 Wall Stop	409	US32D	RO

Set: 6.0

Doors: 103, 104

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Pull Plate	107x70C	US32D	RO
1 Push Plate	70C	US32D	RO
1 Surface Closer	8501 SN-134	689	NO
1 Kick Plate	K1050 10 X 2" LDW	US32D	RO
1 Wall Stop	409	US32D	RO

Set: 7.0

Doors: 102

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	8215 COMI	US26D	SA
1 Surface Closer	8501 SN-134	689	NO

Set: 8.0

Doors: 105B

6 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
2 Exit Device	DG1 NB8713 ETL	US32D	SA
2 Surface Closer	CLP8501	689	NO
2 Kick Plate	K1050 10 X 2" LDW	US32D	RO

Set: 9.0

Doors: 108A

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	DG1 8237 COMI	US26D	SA
1 Surface Closer	8501 SN-134	689	NO
1 Kick Plate	K1050 10 X 2" LDW	US32D	RO
1 Wall Stop	409	US32D	RO

Set: 10.0

Doors: 110

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	DG1 8237 COMI	US26D	SA
1 Surface Overhead Holder/Stop	10-336	689	RF

Set: 11.0

Doors: 125, 126, 127

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	DG1 8237 COMI	US26D	SA
1 Wall Stop	409	US32D	RO

Set: 12.0

Doors: 119

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	DG1 8204 COMI	US26D	SA
1 Electric Strike	1006	630	HS
1 Surface Closer	8501 SN-134	689	NO
1 Kick Plate	K1050 10 X 2" LDW	US32D	RO
1 Wall Stop	409	US32D	RO
1 ElectroLynx Harness	QC-C006		MK
1 ElectroLynx Harness	QC-C1500		MK
1 Power Supply	By Security Vendor		00
1 Card Reader	By Security Vendor		00
1 DPS	By Security Vendor		00

Set: 13.0

Doors: 130

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Set	8265 COMI	US26D	SA
1 Surface Overhead Holder/Stop	10-336	689	RF
1 Surface Closer	8501 SN-134	689	NO
1 Kick Plate	K1050 10 X 2" LDW	US32D	RO

Set: 14.0

Doors: 135

6 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
2 Dust Proof Strike	570	US26D	RO
2 Flush Bolt	2942	US26D	RO
1 Classroom Lock	DG1 8237 COMI	US26D	SA
1 Coordinator	2672	US28	RO
2 Surface Closer	CLP8501	689	NO

Set: 15.0

Doors: 134

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	DG1 8204 COMI	US26D	SA
1 Surface Closer	8501 SN-134	689	NO
1 Wall Stop	409	US32D	RO

Set: 16.0

Doors: 131

6 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
2 Flush Bolt	555	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Storeroom Lock	DG1 8204 COMI	US26D	SA
2 Surface Overhead Holder/Stop	10-336	689	RF

Set: 17.0

Doors: 136

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Set	8215 COMI	US26D	SA
1 Surface Closer	8501 SN-134	689	NO
1 Kick Plate	K1050 10 X 2" LDW	US32D	RO
1 Wall Stop	409	US32D	RO

Set: 18.0

Doors: 145, 146, 147, 148

3 Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Set	8265 COMI	US26D	SA
1 Surface Overhead Holder/Stop	10-336	689	RF

Set: 19.0

Doors: 138, 139, 140, 141, 142, 143

1	Hardware By Door mfg			00

Set: 20.0

Doors: 116

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	DG1 8204 COMI	US26D	SA
1	Surface Closer	8501 SN-134	689	NO
1	Wall Stop	409	US32D	RO

Set: 21.0

Doors: 123

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	DG1 8204 COMI	US26D	SA
1	Surface Closer	8501 SN-134	689	NO
1	Threshold	171A		PE
1	Gasketing	315CN		PE
1	Gasketing	332CR		PE

Set: 22.0

Doors: 108B, 121

1	Pivot	M19	626	RF
1	Pivot Set	195	626	RF
1	Exit Device	DG1 63 8504 863	US32D	SA
1	Electric Strike	9400	630	HS
1	Surface Closer	CLP8501	689	NO
1	Threshold	171A		PE
1	Sweep	18062CNB		PE
1	ElectroLynx Harness	QC-C006		MK
1	ElectroLynx Harness	QC-C1500		MK
1	Power Supply	By Security Vendor		00
1	Card Reader	By Security Vendor		00
1	DPS	By Security Vendor		00

Set: 23.0

Doors: 117

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	DG1 8204 COMI	US26D	SA
1	Electric Strike	1006	630	HS
1	Surface Closer	CLP8501	689	NO
1	Kick Plate	K1050 10 X 2" LDW	US32D	RO
1	Wall Stop	409	US32D	RO
1	Power Supply	By Security Vendor		00
1	Card Reader	By Security Vendor		00
1	DPS	By Security Vendor		00

Set: 24.0

Doors: 137B

3	Hinge	TA2714 4-1/2" x 4-1/2"	US26D	MK
1	Storeroom Lock	DG1 8204 COMI	US26D	SA
1	Electric Strike	1006	630	HS
1	Surface Closer	CLP8501	689	NO
1	Kick Plate	K1050 10 X 2" LDW	US32D	RO
1	Wall Stop	409	US32D	RO
1	ElectroLynx Harness	QC-C006		MK
1	ElectroLynx Harness	QC-C1500		MK
1	Power Supply	By Security Vendor		00
1	Card Reader	By Security Vendor		00
1	DPS	By Security Vendor		00

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Glass and glazing for following applications specified in other Sections, and accessories necessary for installation:
   1. Exterior glazed aluminum walls.
   2. Interior glazed aluminum walls.
   3. Interior windows.
   4. Entrances.

1.2 PERFORMANCE REQUIREMENTS

A. General: Withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to following:
   1. Defective manufacture, fabrication, or installation.
   2. Failure of sealants or gaskets to remain watertight and airtight.
   3. Deterioration of glazing materials.
   4. Other defects in construction.

B. Delegated Design for Exterior Glass: Design glass, including comprehensive engineering analysis according to ASTM E 1300 by a qualified professional engineer, using following design criteria:
   1. Design Wind Pressures: As indicated on Drawings.
   2. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
   3. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.

C. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures:
   1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
   2. Test Interior Ambient-Air Temperature: 75 deg F.
   3. Test Performance: No buckling, stress on glass, sealant failure, or excess stress on framing, anchors, and fasteners and no reduction of performance when tested according to AAMA 501.5.

1.3 SUBMITTALS

A. Product Data: Manufacturer’s technical literature for each product indicated, specified, or required.

B. Samples for Verification: 12 inches square for each type of glass other than clear monolithic vision glass.

C. Warranty: Sample of special warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

B. Source Limitations for Glass: Obtain each glass type from single source from single manufacturer for each glass type.

C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

D. Quality Standards:
   1. GANA’s Glazing Manual.
   2. IGMA’s SIGMA TM-3000.

E. Safety Glazing Labeling: Where safety glazing labeling is indicated or required, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

F. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least

one component lite of units with appropriate certification label of IGCC.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written recommendations for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.7 WARRANTY

A. Special Manufacturer's Warranty for Coated-Glass Products:
   1. Warranty: Standard form in which coated-glass manufacturer agrees to replace coated-glass units that deteriorate within 10 years from date of substantial completion.
   2. Deterioration Includes: Defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions:
      a. Peeling.
      b. Cracking.
      c. Other indications of deterioration in coating.

B. Special Manufacturer's Warranty on Insulating Glass:
   1. Warranty: Standard form in which insulating-glass manufacturer agrees to replace insulating-glass units that deteriorate within 10 years from date of substantial completion.
   2. Deterioration Includes:
      a. Failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions.
      b. Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers named alphabetically below.

2.2 GLASS PRODUCTS, GENERAL

A. Thickness: Not less than 6.0 mm.

B. Strength:
   1. Where float glass is indicated, provide annealed float glass.
   2. Where heat-strengthened glass is indicated, provide Kind HS heat-treated float glass.
   3. Where fully tempered glass is indicated, provide Kind FT heat-treated float glass.

2.3 GLASS SCHEDULE

A. Exterior Vision Lite:
   1. Type: 1 inch thick insulated glass unit.
   2. Outside Lite: Clear, Low E coating on No. 2 surface, 1/4 inch thick.
      a. Performance Requirements:
         1) System U Factor Value: .35 in winter or better.
         2) Solar Heat Gain Coefficient (SHGC): .46 or better.
         3) Visible Light Transmittance: 44 percent or better.
      b. Acceptable Manufacturers and Products:
         1) PPG; Solarbronze with Sungate 500.
   3. Air Space: 1/2 inch.
   4. Inside Lite: Clear, 1/4 inch thick.

B. Exterior Vision Lite for Aluminum and Glass Entrances: Same as Exterior Vision Glass, 1 inch thick.

C. Interior Glass: Fully tempered, clear, float glass, 1/4 inch thick.

2.4 GLASS PRODUCTS

A. Clear Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I, unless otherwise indicated.

B. Uncoated Tinted Float Glass: ASTM C 1036, Type I, Quality-Q3, Class 2, unless otherwise indicated.

C. Heat-Treated Float Glass: ASTM C 1048; Type I; Quality-Q3; Class I (clear) unless otherwise indicated; of kind and condition indicated.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. For uncoated glass, comply with requirements for Condition A.
3. For coated vision glass, comply with requirements for Condition C (other coated glass).

D. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified according to ASTM E 2190, and complying with other requirements specified.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary.
2. Spacer: Aluminum with mill or clear anodic finish.
3. Desiccant: Molecular sieve or silica gel, or blend of both.

2.5 GLAZING GASKETS

A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of following:

1. Neoprene complying with ASTM C 864.
2. EPDM complying with ASTM C 864.
3. Silicone complying with ASTM C 1115.
4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

B. Soft Compression Gaskets: Extruded or molded, closed-cell, integral-skinned neoprene, EPDM, silicone, or thermoplastic polyolefin rubber gaskets complying with ASTM C 509, Type II, black; of profile and hardness required to maintain watertight seal.

2.6 ACCESSORIES

A. General: Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit 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 publications, to comply with system performance requirements.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive glazing and associated Work for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.

3. Starting Work within a particular area will be construed as acceptance of surface conditions.

B. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
   1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
   2. Presence and functioning of weep systems.
   3. Minimum required face and edge clearances.
   4. Effective sealing between joints of glass-framing members.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

3.3 GLAZING

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Adjust glazing channel dimensions as required by Project conditions during installation to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

E. 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.

F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

G. Provide spacers for glass lites where length plus width is larger than 50 inches.
   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.

H. 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.

I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings

exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

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. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing 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 buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 08 8300
MIRRORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Annealed monolithic glass mirrors and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
   1. Silvered mirrored glass. Include description of materials and process used to produce mirrored glass that indicates source of glass, glass coating components, edge sealer, and quality-control provisions.
   2. Mirror mastic.
   3. Mirror hardware.

B. Warranty: Sample of special warranty.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Experience: Installer experienced in performing specified work similar in design, material and extent to scope of Project, and with a record of successful in-service performance.
   2. Supervision: Installer shall maintain a competent supervisor who is on job site during times specified work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
   3. Personnel Training and Certification: Installing personnel shall be trained and certified to install products and systems specified by this Section by the National Glass Association.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect mirrors according to mirror manufacturer's written instructions and as needed to prevent damage to mirrors from moisture, condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with mirror manufacturer's written instructions for shipping, storing, and handling mirrors as needed to prevent deterioration of silvering, damage to edges, and abrasion of glass surfaces and applied coatings. Store indoors.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install mirrors until ambient temperature and humidity conditions are maintained at levels indicated for final occupancy.

1.6 WARRANTY

A. Manufacturers Extended Special Warranty: Furnish warranty for a period of 5 years from date of substantial completion agreeing to repair or replace defects, faulty work and failures, including deterioration, signed by an authorized representative of manufacturer.

B. Deterioration: Includes, but is not limited to, discoloration, black spots, and clouding of the silver film.

C. Exclusions: Includes defects that are attributed to mirror breakage or to maintaining and cleaning mirrors contrary to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SILVERED FLAT GLASS MIRRORS

A. Glass Mirrors: ASTM C 1503; manufactured using copper-free, low-lead mirror coating process.

2.2 MISCELLANEOUS MATERIALS

A. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.

B. Edge Sealer: Coating compatible with glass coating and approved by mirror manufacturer for use in protecting against silver deterioration at mirrored glass edges.

C. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.

2.3 MIRROR HARDWARE

A. Top and Bottom J-Channels: Type 304 stainless steel extrusions with a return deep enough to produce a glazing channel to accommodate mirrors of thickness indicated and in lengths required to cover bottom and top edges of each mirror in a single piece.
   1. Bottom Trim: J-channels formed with front leg and back leg not less than 3/8 and 7/8 inch in height, respectively, and a thickness of not less than 0.05 inch.
   2. Top Trim: J-channels formed with front leg and back leg not less than 5/8 and 1 inch in height, respectively, and a thickness of not less than 0.3075 inch.
   3. Finish: No. 4 satin.

B. Fasteners: Stainless steel flat head machine screws.

C. Anchors and Inserts: Provide devices as required for mirror hardware installation. Provide toothed or lead-shield expansion-bolt devices for drilled-in-place anchors. Provide galvanized anchors and inserts for applications on inside face of exterior walls and where indicated.

2.4 FABRICATION

A. Mirror Edge Treatment:
   1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
   2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to which mirrors will be applied for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Comply with mastic manufacturer's written installation instructions for preparation of substrates, including coating substrates with mastic manufacturer's special bond coating where applicable.

3.3 INSTALLATION

A. Wall-Mounted Mirrors: Install mirrors with mastic and mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
   1. Top and Bottom J-Channels: Provide setting blocks 1/8 inch thick by 4 inches long at quarter points. To prevent trapping water, provide, between setting blocks, two slotted weeps not less than 1/4 inch wide by 3/8 inch long at bottom channel.
   2. Install mastic as follows:
      a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
      b. Apply mastic to comply with mastic manufacturer's written instructions for coverage and to allow air circulation between back of mirrors and face of mounting surface.
      c. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.

3.4 PROTECTION

A. Protect mirrors from breakage and contaminating substances resulting from construction operations.

B. Do not permit edges of mirrors to be exposed to standing water.

END OF SECTION

SECTION 09 2900
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Non-load-bearing metal stud framing, interior gypsum board wall and ceiling assemblies and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

1.3 QUALITY ASSURANCE

A. Mockups: Before finishing gypsum board assemblies, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and qualities of materials and execution.
   1. Install mockups for the following applications:
      a. Surfaces with texture finishes.
      b. Surfaces indicated to receive nontextured paint finishes.
      c. Surfaces indicated to receive textured paint finishes.
   2. Simulate finished lighting conditions for review of mockups.
   3. Approved mockups may become part of the completed Work if undisturbed at time of substantial completion.

1.4 PROJECT CONDITIONS

A. Environmental Conditions: ASTM C 840 requirements or respective wallboard manufacturers written recommendations, whichever are more stringent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products and assemblies specified below to establish a standard of quality. Other acceptable manufacturers (where more than one manufacturer is indicated) or available manufacturers (where no other manufacturers are indicated) with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below.

C. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into Work include, but are not limited to, those listed.

2.2 SUSPENDED GRID SYSTEM FOR INTERIOR CEILINGS

A. Suspension System:
   1. Material Quality Standard: ASTM C 645, heavy-duty rating.
   2. Description: Manufacturer's standard direct-hung suspended grid system composed of main beams and cross furring members that interlock to form a modular supporting network for application of gypsum board.
   3. Material: Sheet steel with corrosion protection coating.
   4. Main Beams: Inverted T-shaped profile of single or double mounting flange; minimum 1-1/2 in profile height with top bulb and minimum 1-3/8 in wide knurled mounting flange; factory punched for hanger wire, and to receive cross furring members.
   5. Cross Furring Members:
      a. Tees: Inverted T-shaped profile of single or double mounting flange; 1-1/2 in profile height with top bulb and minimum 1-3/8 in wide knurled mounting flange; with ends formed for positive interlocking with main beam.
      b. Channels: Inverted hat shaped profile; minimum 7/8 in profile height and minimum 1-3/8 in wide knurled mounting flange; with ends formed for positive interlocking with main beam.
   6. Wall Angle: Angle shaped profile with each leg not less than 1-1/4 in.
   7. Accessories: Specifically designed as an integral part of suspended grid system.

8. Acceptable Manufacturers and Products:
    a. Armstrong World Industries Inc.; Furring System/Drywall.
    b. Chicago Metallic Corp.; 640-C/660-C Drywall Furring System.
    c. USG Interiors, Inc.; Drywall Suspension System.

B. Hanger Attachments to Concrete:
1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

C. Wire:
1. Material Quality Standard: ASTM A 641, Class 1, zinc-coated, soft annealed, mild steel wire.
2. Tie Wire Minimum Size: Single 0.0625 in (16 ga) diameter strand, or double 0.0475 in (18 ga) diameter strands. Preformed furring channel clips are acceptable.
3. Hanger Wire Minimum Size: 0.1620 in (8 ga) diameter.

2.3 NON-STRUCTURAL METAL FRAMING FOR WALLS, PARTITIONS AND FURR-DOWNS

A. Material Quality Standard: Provide components of sizes indicated but not less than that required to comply with ASTM C 754 for conditions indicated.
1. Steel Sheet: ASTM C 645 for metal.
2. Protective Coating: ASTM A 653, G40 hot-dip galvanized coating.

B. Metal Studs and Floor Track (Runners):
1. Stud Description: C-shaped members formed from galvanized steel sheet with 1-1/4 in flange edges bent back 90 degrees and doubled over to form 3/16 in wide minimum return lip; of web depth indicated on Drawings and uncoated base metal thickness indicated in Schedule at end of this Section; with web punchouts.
2. Track (Runner) Description: U-shaped members formed from galvanized steel sheet with depth compatible with studs and flange dimension indicated to hold studs by friction; of same web size and uncoated base metal thickness as studs.
    a. Floor Track (Runner): 1 in.
    b. Head of Wall Track (Runner): 3 in.

C. Flat Straps and Back-Up Plates: Galvanized steel sheet for blocking and bracing in length and width indicated, of same uncoated base metal thickness as adjacent metal studs.

D. Bridging:
1. Channel: U-shaped members formed from cold-rolled galvanized steel sheet 0.0538 in (16 ga) minimum uncoated base metal thickness with 1/2 in flanges and depth fitting stud punchouts.
2. Clip Angle: 1-1/2 in by 1-1/2 in L-shaped members formed from galvanized steel sheet not less than 0.068 in (14 ga) uncoated base metal thickness.

2.4 GYPSUM WALLBOARDS

A. Sizes: Maximum lengths and widths available that will minimize short edge-to-short edge butt joints and to correspond to support system indicated.

B. Typical Paper-Faced Gypsum Board:
1. Material Quality Standard: ASTM C 1396, Type X.
2. Description: Noncombustible gypsum core with paper surfacing on face, back and long edges; tapered long edges; 5/8 in thick.
3. Acceptable Manufacturers and Products:
    a. CertainTeed Corp.; ProRoc Type X Gypsum Board.
    b. G-P Gypsum Corp.; ToughRock Fireguard Gypsum Board.
    c. National Gypsum Co.; Gold Bond Fire-Shield Wallboard.
    d. USG Corp.; Sheetrock Firecode Core.

C. Enhanced Resistance Paper-Faced or Glass-Mat Gypsum Board:
   1. Moisture-Resistant Paper-Faced Gypsum Board:
      a. Material Quality Standard: ASTM C 1396, Type X.
      b. Description: Enhanced moisture-resistant, noncombustible gypsum core, with moisture-resistant paper surfacing on face, back and long edges; tapered long edges; score of 10 according to ASTM D 3273; 5/8 in thick.
      c. Acceptable Manufacturers and Products:
         1) CertainTeed Corp.; ProRoc Moisture and Mold Resistant Type X Gypsum Board.
         2) National Gypsum Co.; Gold Bond XP Gypsum Board.
         3) Temple-Inland Inc.; ComfortGuard Mold-Resistant Gypsum Wallboard.
         4) USG Corp.; Sheetrock Mold Tough Firecode Gypsum Board.
   2. Moisture-Resistant Paperless Glass-Mat Gypsum Board:
      a. Material Quality Standard: ASTM C 1177.
      b. Description: Enhanced moisture-resistant, noncombustible gypsum core with inorganic, embedded fiberglass mat on both faces; square edges; score or 10 according to ASTM D 3273; 5/8 in thick.
      c. Basis of Design: G-P Gypsum Corp.; DensArmor Plus Fireguard Interior Guard.

D. Enhanced Resistance Coated Glass-Mat Gypsum Board:
   1. Material Quality Standard: ASTM C 1178.
   2. Description: Enhanced moisture-resistant, noncombustible, gypsum core with inorganic, embedded fiberglass mat on both sides; outside face coated with heat-cured copolymer water-resistant coating; square edges; score or 10 according to ASTM D 3273; 5/8 in thick.
   3. Basis of Design: G-P Gypsum Corp.; DensShield Tile Backer.

2.5 CEMENTITIOUS WALLBOARDS

A. Cementitious Backer Units:
   1. Material Quality Standard: ANSI A118.9 or ASTM C 1325.
   2. Description: Cementitious panels composed of portland cement, aggregates, glass mesh on both faces, and manufacturer's proprietary ingredients; capable of remaining unaffected by prolonged exposure to water; 5/8 in thick.
   3. Acceptable Manufacturers and Products:
      a. Custom Building Products; WonderBoard.
      b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
      c. National Gypsum Co.; PermaBase Cement Board.
      d. USG Corp.; DUROCK Interior Cement Board.

2.6 TRIM ACCESSORIES

A. Typical Drywall Trim Accessories:
   1. Material Quality Standard: ASTM C 1047.
   2. Description: Trim profile fabricated of steel sheet with ASTM A 653, minimum G40 hot-dip galvanized coating; of size suitable for wallboard thickness; with recessed, perforated flange formed to receive joint compound.
   3. Trim Products:
      a. Cornerbead:
         1) Purpose: For protecting outside (external) corners.
         2) Basis of Design: USG Corp.; Dur-A-Bead Corner Bead, 103.
      b. LC-Bead (J-Bead):
         1) Purpose: For protecting exposed edges of wallboard where back flange can be used.
         2) Basis of Design: USG Corp.; J-Trim, 200-A.
      c. L-Bead:
         1) Purpose: For protecting exposed edges of wallboard where back flange cannot be used.
         2) Basis of Design: USG Corp.; L-Trim, 200-B.
      d. J-Stop:

1) Purpose: For protecting edges of wallboard that does not require finishing.
2) Basis of Design: USG Corp.; J-Stop, 402.

e. Control Joint:
1) Description: One-piece trim formed with V-shaped slot, with removable strip covering slot opening.
2) Purpose: For conditions requiring expansion and contraction stresses of large areas of wallboard to be relieved.
3) Basis of Design: USG Corp.; Control Joint, 093.

f. Other Trim or Special Shapes: Product as required by condition.

4. Available Manufacturers:
a. Dietrich Industries, Inc.; Unimast.
b. Fry Reglet Architectural Metals.
c. Marino Ware; Division of Ware Industries.
d. Niles Building Products Co.
e. Superior Metal Trim; Division of Delta Star, Inc.
f. USG Corp.

2.7 FASTENERS

A. Limitation: Nails and staples are not permitted.

B. Ceiling Wire Hanger Attachments to Building Structure:

1. Mechanical Anchors:
a. Description: Suitable for application indicated, fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires of type indicated; and capable of sustaining, without failure, an ultimate load capacity not less than 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
b. Available Manufacturers:
1) Construction Materials, Inc.
2) Heckman Building Products, Inc.

2. Powder Actuated Fastener Driven Ceiling Clip:
a. Description: ANSI A10.3; low velocity, powder actuated fasteners; drive pins and clip angles, fabricated from corrosion-resistant materials, for attaching hanger wire of type indicated; and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
b. Available Manufacturers:
1) Hilti Corp.
2) ITW Ramset/Red Head.
3) Powers Fasteners.
4) Simpson Strong Tie Anchor Systems.

C. Powder Actuated Fasteners for Attaching Metal Framing to Structure:

1. Description: ANSI A10.3; low velocity, powder actuated fasteners; drive pins and washers fabricated from corrosion-resistant materials; powder loads suitable for application indicated; and capable of sustaining, without failure, an ultimate load capacity not less than 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
2. Available Manufacturers:
a. Hilti Corp.
b. ITW Ramset/Red Head.
c. Powers Fasteners.
d. Simpson Strong Tie Anchor Systems.

D. Metal Framing Screws: Screw fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten metal framing and furring members securely to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

E. Gypsum Wallboard Screws:

1. Material Quality Standards:
   a. Metal Framing Members less than 0.03 in Thick: ASTM C 1002, Type S.
   b. Metal Framing Members from 0.033 in to 0. 0.112 in Thick: ASTM C 954, Type S-12.
2. Description: Bugle head, self-drilling, self-tapping, steel screws with Phillips-head recess of size, holding power, and other properties recommended by respective wallboard manufacturer; non-corrosive and non-oxidizing for shower and tub applications.

F. Cementitious Wallboard Screws: Self-drilling, self-tapping, steel screws of type, material, size, corrosion resistance, holding power, and other properties recommended by respective wallboard manufacturer.

G. Miscellaneous Fasteners: For conditions not indicated, fasteners shall be type, finish, size, and holding power recommended by respective wallboard manufacturer and conditions.

2.8 JOINT TREATMENT AND TEXTURE MATERIALS

A. Material Quality Standard: ASTM C 475.

B. Joint Tape:
1. Paper Tape: Nominal 2 in wide cross-fibered paper tape with finish suitable for bonding, creased in center for easy folding, and compatible with joint compound.
2. Mesh Tape: Nominal 2 in wide self-adhering 10-by-10 fiberglass mesh tape.

C. Joint Compound:
1. Setting-Type: Job-mixed powder for mixing with water, chemical-hardening compound; includes taping types.
2. Drying-Type: Ready-mixed or job-mixed powder for mixing with water, air-drying, vinyl based compounds; includes taping, topping, and all-purpose types.

D. Texture Finish:
1. Primer: As recommended by textured finish manufacturer.
2. Aggregate Finish: Water-based, job-mixed, aggregated, drying-type texture paint for spray application.
3. Basis of Design: USG Corp.; Sheetrock Wall and Ceiling Spray Texture Paint (Aggregated).
4. Texture: Light Orange Peel.

2.9 RELATED MATERIALS

A. Fiberglass Sound Attenuation Blankets:
1. Material Quality Standard: ASTM C 665, Type I.
2. Description: Unfaced blankets produced by bonding inorganic glass fibers with a thermosetting binder.
3. Thickness: Not less than full thickness of wall, unless otherwise indicated.
4. Available Manufacturers:
   a. CertainTeed Corp.; CertaPro AcoustaTherm Batts.
   b. Johns Manville Building Insulation Div.; Sound Control Batts.
   c. Knauf Fiber Glass; QuietTherm.
   d. Owens Corning; Sound Attenuation Batts.

B. Acoustical Sealant:
1. Description: Nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 that is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.
2. Available Manufacturers and Products:
   a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
   b. Quiet Solutions; QuietSeal.
   c. USG Corp.; Sheetrock Acoustical Sealant.

C. Acoustical Putty Pads:
1. Product Quality Standard: UL 1479.
2. Description: Non-hardening, moldable, intumescent compound formed into sheets designed to seal penetrations, construction gaps, and around electrical boxes.
3. Available Manufacturers and Products:

a. Grace Construction Products; Flamesafe FSP 1077 Putty Pads.
b. Hilti; CP 617 Intumescent Acoustic Putty Pad.
c. KnaufDrywall; Putty Pads.
d. Quiet Solution; QuietPutty.
e. Specified Technologies, Inc; Series SSP Putty Pads.
f. Tremco; TREMstop Electrical Box Insert.
g. 3M; Fire Barrier Moldable Putty+ Pads.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which gypsum board assemblies attach or abut building structural framing, including hollow metal door frames, for compliance with requirements, installation tolerances and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected.
3. Starting work within a particular area will be construed as acceptance of conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform gypsum board assemblies work according to following, unless otherwise specified in this Section:
1. GA 216.
2. ASTM C 754.
3. ASTM C 840.
4. Respective manufacturer's written installation instructions.
5. Approved submittals.
6. Contract Documents.

B. Control Joints: Form stress relieving joints, spaced not more than 24 feet in either direction for uninterrupted straight planes of ceilings, walls and partitions, to eliminate cracking of gypsum board assemblies, or finish, according to following:
1. Where ceiling, wall or partition metal framing changes direction within same plane.
2. Where wallboard of ceilings, walls or partitions abutting inside face of exterior walls.
3. Where wings of L, U, or T shaped ceiling configurations are joined.
4. Less than ceiling height door frames and windows extending from both corners to ceiling.

C. Isolation from Building Structure: Isolate gypsum board assemblies from building structure to prevent transfer of loading imposed by structural movement.
1. Provide isolation joints are indicated or required by installation quality standards.
2. Isolate ceiling assemblies abutting or penetrated by building structure.
3. Isolate partition framing and wall furring abutting or penetrated by building structure, except at floor.

D. Acoustical Putty Pads: Hand apply pads to surfaces indicated, packing tightly into gaps and openings, in such a manner that pad will remain secured to surface; pinch pleat excess material together to close gaps.

E. Supplemental Accessories: Install supplementary framing, blocking, reinforcing, and bracing in gypsum board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, hand rails, furnishings, or similar construction. Comply with details indicated and recommendations of installation quality standards or manufacturer.

3.3 INSTALLING SUSPENDED GRID SYSTEM CEILINGS

A. Pattern: Lay out spaces and arrange suspension system in a regular pattern, parallel or perpendicular to surrounding walls.

B. Hangers for Ceiling System: Suspend hangers from building structural members and as follows:
1. Install hangers plumb and free from contact with mechanical and electrical equipment, insulation or other objects within ceiling plenum that are not part of supporting structural frame or ceiling suspension system. Within limitations allowed by installation quality standards, 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 location of hangers required to support 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 installation quality 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. Install metal framing components for suspended ceilings so that members are level to within 1/8 in in 12 ft as measured both lengthwise on each member and transversely between parallel members.
5. Do not attach hangers to steel roof deck. Attach hangers to structural members.
6. Do not connect or suspend any ceiling components from ducts, pipes or conduit.

C. Perimeters: Using wallboard screws through wallboard into metal studs, attach perimeter wall angle where suspended grid system meets vertical surfaces; cut main beams and cross furring members to fit into wall angle.

D. Main Beams:
1. Suspend main beams spaced 48 in on center from structure with wire hangers spaced not greater than 48 in on center.
2. Install main beams level within 1/8 in in 12 ft with hanger wire taut and tightly wrapped to prevent vertical movement or rotation.
3. Do not make local kinks or bends in hanger wires as a means of leveling.

E. Cross Furring Members:
1. Install cross furring members at right angles to main beams, spaced as required and join to main beams with positive interlock.
2. Install cross furring members to within 1/32 in of their required location and within 0.015 in of same horizontal plane as main beam, and never below continuous member.
3. Install additional cross furring members at right angles to beams and cross furring members to support ends of recessed light fixtures, diffusers or grilles.

F. Concentrated Load Conditions: Provide additional hanger wires at each corner of recessed light fixtures and other concentrated load conditions to prevent excess deflection.

3.4 INSTALLING METAL FRAMING FOR WALLS, PARTITIONS AND FURR-DOWNS

A. Priority: Assemble various assemblies giving priority to partitions with higher rating; extend partition with higher rating intact through partition with lower rating.

B. Joinery and Connections: Install various metal framing components according to details indicated; for situations and conditions not indicated, comply first with installation quality standards, then second with respective manufacturers recommendations.

C. General Requirements: Construct partition framing of studs, tracks, and headers using screws of number and spacing required.
1. Install studs of uncoated base metal thickness as determined by metal stud schedule at end of this Section.
2. Extend partition framing full height to underside of structure above, except where partitions are indicated to terminate at, or immediately above, suspended ceilings.
3. Continue framing over door frames and openings to provide support for wallboard.
4. Space studs as indicated on schedule at end of this Section.
5. Cut studs 1 in short of full height to provide deflection relief at head of wall conditions.
6. Install studs so that flanges point in same direction.
7. Attach with screws through each stud flange and track (runner) flange.
8. At intersections and corners, locate studs no more than 2 in from partition intersections and corners and secure with screws through both flanges of studs and tracks.
9. Install horizontal bridging at 48 in on centers vertically where indicated or required by installation quality standard.

D. Metal Track (Runner) Requirements:
1. Floors: Install tracks (runners) using powder actuated fasteners spaced not more than 16 in on centers.
2. Head of Wall: Install deep leg deflection tracks using powder actuated fasteners to

laterally support assembly, and to avoid axial loading of assembly by deflection from building structure above.

E. Support for Wall Mounted Accessory/Equipment: Install back-up plate or track (runner) turned on its side, using screws as indicated or as required, to studs to properly transfer accessory/equipment load to metal framing.

F. Openings: Frame single door, double door, above ceiling openings, and below ceiling openings using studs, tracks (runners), clip angles, and headers.
   1. Install 2 studs on each side of each opening, including strap plates; extend from floor to underside of structure above; do not cut these studs under any circumstances.
   2. Construct header of appropriate configuration for type of opening to be spanned and secure with clip angles; include sound attenuation blankets within cavity when partition is scheduled to have a sound resistance rating.
   3. Install short intermediate studs 16 in on center between top track and header.
   4. At partitions indicated to terminate immediately above ceiling, install diagonal bracing at 48 in on center maximum.

G. Supplementary Framing: Install around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by metal framing.

H. Chase Partitions:
   1. Position double row of studs vertically in tracks (runners), opposite each other in pairs with flanges pointing in same direction.
   2. Space as indicated on schedule at end of this Section.
   3. Attach with screws through each stud flange and track (runner) flange.
   4. Cross brace between rows of studs with one of following at 48 in on center maximum vertically, attached to stud webs with screws:
      a. Coated glass-mat gypsum board, 12 in high by chase width.
      b. Metal studs turned on side, webs back-to-back.

I. Furred Walls:
   1. Erect furring channels vertically, spaced 16 in on centers maximum, unless otherwise indicated.
   2. Attach with powder actuated fasteners, staggered on flanges.
   3. Splice ends by nesting channels 8 in and securely anchoring to surface.
   4. Miter 24 in long horizontal furring channels at corners and space 24 in on centers vertically.
   5. Locate furring channels around perimeter of openings and secure to surfaces.

J. Control Joints: Construct metal framing as indicated by installation quality standard to allow wallboard control joints to function as intended.

K. Metal Framing Spanning Multiple Floors: Construct metal framing as required using longest length metal studs possible and attach to building structure with floor bypass clips.

L. Installation Tolerances: Install each metal stud metal framing and furring member so that fastening surfaces do not vary more than 1/8 in from plane formed by faces of framing members.

3.5 INSTALLING WALLBOARDS

A. General Requirements:
   1. Install type of wallboard at location indicated by wallboard schedule at end of this Section.
   2. Avoid installing imperfect, damaged, wet, or damp wallboards.
   3. Install ceiling wallboards before wall and partition wallboards.
   4. Install wallboards with finishable face side out.
   5. Butt wallboards together for a light contact at edges and ends with not more than 1/16 in of open space between panels.
   6. Avoid forcing wallboards into place.
   7. Avoid placing tapered edges against cut edges or ends.

B. Isolation from Building Structure:
   1. Isolate perimeter of walls and partitions at structural abutments, except floors.

2. Provide 1/4 in to 1/2 in wide spaces at these locations and trim edges with edge trim where edges of wallboards are exposed.
3. Seal joints between edges and abutting structural surfaces with acoustical sealant.

C. Single-Layer Board Assemblies:
1. At typical conditions, install wallboard vertically (long dimension parallel to metal framing), to minimize short end-to-short end joints.
2. At high walls, install wallboards horizontally. Stagger abutting end joints not less than one framing member in alternate courses of wallboards.

D. Ceiling Applications:
1. Apply wallboard at right angles to main beams of suspension framing to minimize number of abutting end joints and avoid abutting end joints in central area of each ceiling.
2. Stagger abutting end joints of adjacent panels not less than one framing member.
3. Locate both edge or end joints of wallboards over intermediate supports or gypsum board back-blocking where metal framing is not present.

E. Typical Wall Applications:
1. Attach wallboards to metal studs so that leading edge or end of each board is attached to open (unsupported) edges of stud flanges first.
2. Stagger vertical joints on opposite sides of partitions.
3. Do not make joints other than control joints at corners of framed openings.
4. Attach wallboards to framing provided at doors, openings and cutouts. Install wallboards over door heads and extend to not less than one stud space (16 in) at each side of door or opening.
5. Cover both faces of metal framing with wallboards as indicated, except in chase walls that are braced internally.
6. Cut and fit wallboards around ducts, pipes, conduits, and other penetrations to form proper annular joint.
7. Where partitions intersect open building structure members projecting below underside of floor slabs and roof decks, cut to fit profile formed by coffers, joists, beams, and other structural members.
8. Support both edge and end joints of wallboards over metal framing.

F. Screw Attachments:
1. Attach wallboard to metal framing with screw fasteners for wallboard being installed:
   a. Type shall be appropriate for material and conditions.
   b. Length shall be as required by condition and penetrating metal framing not less than 3/8 in.
   c. Spacing shall be as recommended by installation quality standard, wallboard manufacturer or respective assembly test report.
   d. Use properly adjusted, positive-clutch electric power tool equipped with adjustable screw-depth head and a Phillips bit. Nails and staples are not permitted.
2. Drive screws to slightly dimple surface without breaking face paper, fracturing core, or stripping metal framing member around screw shank.
3. Space screws as recommended by installation quality standards.
4. Start field screwing near center and work towards edges.
5. Space screws not less than 3/8 in from wallboards edges.
6. Do not attach wallboards to top runner where wall or partition extends to building structure.

G. Acoustically Enhanced Gypsum Board: Coordinate installation of wallboard with acoustical sealant and acoustical putty pads according to manufacturer written installation instructions.

H. Control Joints: Form control joints and expansion joints at locations indicated with required space between edges of adjoining wallboards.

I. Sound Attenuation Blankets: Install blankets within stud cavities set so that they are held in place by friction with metal studs; ensure blankets are secure within cavity and will not become displaced when second wallboard side is closed.

J. Sealant:
1. Comply with ASTM C 919 and manufacturers written recommendations for closing off

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

2. Seal wall assemblies at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant material.

3.6 INSTALLING TRIM ACCESSORIES

A. General: Fasten trim accessories continuously according to accessory manufacturer's instructions using wallboard screws; installation by clinch-on tool and staples not permitted.

B. Typical Trim Accessories:

1. Corner Beads: Install trim at external corners; use screws at each flange at 9 in on centers, opposite each other.
2. Edge Trim: Install trim where wallboards abut dissimilar material, and where edge of wallboards would otherwise be exposed; use screws at flange at 9 in on centers.
   a. LC-Bead (J-Bead): Install trim at exposed conditions where back flange can be attached to framing or supporting substrate before wallboard installation.
   b. L-Bead: Install trim at exposed conditions where trim can only be installed after wallboard installation.
   c. J-Stop: Install trim at concealed conditions where trim can only be installed after wallboard installation.
3. Control Joints: Install trim at appropriate locations, ensuring wallboard is not continuous over joint; use screws at each flange at 6 in on centers.

3.7 FINISHING GYPSUM BOARD

A. General: Treat board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare surfaces for decoration.

B. Joint Tape: Finish joints according to following:

1. Typical Paper-Faced Gypsum Board: Paper.
2. Enhanced Resistance Paper-Faced Gypsum Board: Mesh tape.
3. Cementitious Backer Units: Mesh tape.

C. Finishing: Finish boards and units to achieve specified level of finish as indicated in schedule at end of Section:

1. Typical Paper-Faced Gypsum Board: Either or combination of both of following:
   a. Setting-type joint compounds.
   b. Drying-type joint compounds.
2. Enhanced Resistance Paper-Faced Gypsum Board: Setting-type joint compounds.
3. Cementitious Backer Units: Setting-type joint compounds.

D. Texture:

1. Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
2. Mix texture 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.
3. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture finish manufacturer's written recommendations.

3.8 ADJUSTMENTS

A. Wet Materials: Materials and products that are wet or have been wet at any time during construction shall be replaced with new and dry materials and products.

3.9 SCHEDULES

A. Metal Stud Schedule:

1. Stud Depth: As indicated on Drawings.
2. Spacing: Maximum 16 in on centers, unless otherwise indicated, or, as required to comply with respective assembly test report.
3. Uncoated Base Metal Thickness:
   a. Partitions Supporting Wall-Mounted Components: As indicated on Structural

Drawings.

b. Typical Partitions: As determined by manufacturer's limiting height engineering data for L/240 at 5 lb/sq ft lateral load.

B. Wallboard Schedule: Install gypsum board products indicated in following Schedule unless otherwise indicated on Drawings:

For purposes of this schedule, exposure to water or moisture shall be defined as follows: - Direct Exposure: Surfaces normally soaked, saturated, or, regularly and frequently exposed to water and/or moisture. - Incidental Exposure: Surfaces immediately adjacent to lavatories, sinks, urinals, water closets, and other plumbing fixtures. - No Exposure: Surfaces in locations not normally exposed to water or moisture sources. Locations of paper-faced acoustically enhanced gypsum board are indicated on Drawings.			TYPICAL PAPER-FACED	ENHANCED RESISTANCE PAPER-FACED OR GLASS-MAT	CEMENTITIOUS BACKER UNITS
WALLS and CEILINGS within following rooms (Incidental Exposure): MECHANICAL EQUIPMENT ROOMS JANITOR CLOSETS				X	
TOILETS AND BATHROOMS	WALLS with adjacent plumbing fixtures – "WET WALLS" (Incidental Exposure)	Paint only		X	
		Tile Coverings			X
	WALL locations other than "wet walls" (No Exposure)	Paint only		X	
		Tile Coverings			X
	Suspended CEILINGS (No Exposure)	Paint only		X	
	WALLS above ceilings (Incidental Exposure)		X	X	
INTERIOR FACE of EXTERIOR WALLS (No Exposure, except for future potential of water or moisture infiltration through exterior wall) – Paint and Wall Coverings				X	
TYPICAL WALLS and CEILINGS Not scheduled otherwise (No Exposure)		Paint only	X		

C. Gypsum Board Finish Schedule: Finish panels to levels indicated below. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape. Sand between coats and after last coat to produce a surface free of defects and ready for decoration.

1. Preparation: Apply joint compound at open joints, panel edges, and damaged surface areas.
2. Level 1: At following locations, embed tape at joints in joint compound:
   a. Ceiling plenum areas above ceilings.
   b. Concealed areas.
3. Level 2: At following locations, embed tape and apply separate first coat of joint compound to tape, fasteners, and trim flanges:
   a. Moisture-resistant paper-faced gypsum board used as substrate for ceramic tile.

4. Level 3: At following locations, embed tape and apply separate first and second coats of joint compound to tape, fasteners, and trim flanges:
   a. Mechanical, electrical, telephone and elevator equipment rooms.
   b. Stairs.
5. Level 4: At following locations, embed tape and apply separate first, fill, and finish coats of joint compound to tape, fasteners, and trim flanges:
   a. Areas to receive paint.
   b. Areas exposed to view.

END OF SECTION

SECTION 09 3000
TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Modular porcelain tile, setting and grouting materials, and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's technical literature for each type of tile, mortar materials, grouting materials, and other products indicated, specified, or required.

B. Grout Samples for Initial Selection: Manufacturer's color charts consisting of actual sections of grout showing the full range of colors available for each type of grout indicated.

C. Samples for Verification Purposes: Submit samples for each item listed below of size and construction indicated. Where products involve normal color and texture variations, include sample sets showing the full range of variations expected.

1. Tile: Each type and composition of tile and for each color and finish required, at least 12 in square, mounted on rigid panel, and with grouted joints using product complying with specified requirements and in color approved for completed work.
2. Tile Trim and Accessories: Full-size units of each type and for each color required.
3. Metal Edge Strips: 6 in lengths of specified profile.

D. Maintenance Data: Include in operation and maintenance manual required by Division 01.

1. Submit manufacturer's instructions for maintenance of installed work, including methods and frequency for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning materials and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Tile Installer Qualifications:

1. Experience: Company with minimum 10 years specialized experience installing work similar to scope of this project and having record of successful in-service performance and completion of projects.
2. Field Supervision: Installer shall maintain a full time supervisor on job site during times specified work is in progress who has minimum 10 years experience similar to type and scope required for this project.

B. Accessibility Requirements for Floor Tile:

1. Standards: Products and installation shall comply with Americans with Disabilities Act (ADA), ANSI A117.1, and state and local accessibility standards.
2. Floor Tile Slip Resistance: Minimum static coefficient of friction as follows according to ASTM C 1028 without use of abrasive grain:
   a. Level Floor Surface: 0.6.
   b. Steps: Minimum 0.6.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Install tile only when construction in room is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

1.5 MAINTENANCE

A. Extra Materials: Furnish quantity of full-size tile and trim units equal to 2.0 percent of quantity installed, for each type, composition, color, pattern, and size, packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified on Drawing Sheet A1.3 to establish a standard of quality. Other acceptable manufacturers (where more than one manufacturer is indicated) or available manufacturers (where no other manufacturers are indicated) with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as

judged by Architect.

B. Acceptable Manufacturers: Subject to compliance with requirements, provide product by one of the manufacturers listed.

C. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into Work include, but are not limited to, those listed.

2.2 TILE PRODUCTS

A. Tile: Products that are equivalent to color, texture, pattern, finish, appearance, and material quality characteristics indicated by basis of design selection.

2.3 SETTING (MORTAR AND GROUT) MATERIALS

A. Material Quality Standards: ANSI A118 Series indicated.

B. Thin-Set Mortar:
   1. Material Quality Standard: ANSI A118.4.
   2. Basis of Design: Mapei; Ultraflex 2.

C. Medium-Set Mortar:
   1. Material Quality Standard: ANSI A118.4.
   2. Basis of Design: Mapei; Ultraflex LFT.

D. Latex-Portland Cement Grout for Wall Tile:
   1. Material Quality Standard: ANSI A118.3.
   2. Basis of Design: Mapei; Opticolor.

E. Epoxy Grout for Floor Tile:
   1. Material Quality Standard: ANSI A118.3.
   2. Basis of Design: Mapei; Kerapoxy CQ.

F. Acceptable Manufacturers:
   1. Bonsal American.
   2. Bostik, Inc.
   3. Custom Building Products.
   4. Laticrete International, Inc.
   5. Mapei Corp.
   6. TEC Specialty Products Inc.

2.4 ELASTOMERIC SEALANTS

A. Sealant Colors: Match color of adjacent grout unless otherwise indicated.

B. Wall Joint Sealant:
   1. Material Quality Standard: ASTM C 920, Type S, Grade NS, Class 25, with following physical properties:
      a. Integral antimicrobial product added during manufacturing to resist mold and mildew growth.
      b. Intended for sealing interior ceramic tile joints and other nonporous substrates.
      c. Resistant to in-service exposures of high humidity and temperature extremes.
   2. Generic Description: One-part, mildew-resistant, silicone sealant.
   3. Available Manufacturers and Products:
      a. Degussa Construction Chemicals, Sonneborn; Omniplus.
      b. Dow Corning Corp.; 786.
      c. Pecora Corp.; 898.
      d. Tremco Inc.; Tremsil 200.

C. Chemical Resistant Floor Joint Sealant:
   1. Generic Description: Two-part, self-leveling, epoxy sealant.
   2. Available Manufacturers and Products:
      a. Euclid Chemical Co.; Euco 800.
      b. L&M Construction Chemical Inc.; Epoflex SL.

D. Backer Rods:
   1. Material Quality Standard: ASTM C 1330, Type B.
   2. Description: Non-gassing (when punctured), bi-cellular polyethylene or polyolefin foam rod with a surface skin, of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
   3. Available Manufacturers and Products:

a. Degussa Building Systems, Sonneborn; Soft Backer Rod.
b. Nomaco Inc.; Sof Rod.

E. Backer Tape: Bond-breaking polyethylene or other plastic tape, self-adhesive where applicable, recommended by sealant manufacturer for preventing sealant from adhering to back of joint where such adhesion would result in sealant failure.

2.5 RELATED MATERIALS

A. Underlayments: Trowelable or self-leveling as required by conditions; pre-mixed, latex-modified, portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

B. Patching Compounds: Trowelable pre-mixed, latex-modified, portland cement based formulation provided by or specifically approved by setting material manufacturer; include primers if required for concrete substrate condition.

C. Metal Trim:
1. Description: Profile and dimension suitable for thin-set application.
2. Basis of Design:
a. Transition of Tile Floor to Polished Concrete Flooring: Schluter Systems LP; Reno-Ramp/-K, AERP 125 B65, clear anodized aluminum.
b. Outside Corner: Schluter Systems LP; Rondec, size as required by tile thickness, clear anodized aluminum.
c. Top of Wainscot: Schluter Systems LP; Rondec, size as required by tile thickness, clear anodized aluminum.
3. Acceptable Manufacturers:
a. Ceramic Tool Co.
b. Schluter Systems LP.

D. Tile Cleaner: Neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, provided by or specifically approved by tile and grout manufacturers.

E. Grout Sealer: Silicone product for sealing unglazed tile and grout joints that does not change color or appearance of tile or grout, provided by or specifically approved by tile and grout manufacturers.

2.6 MIXING MORTARS AND GROUT

A. General Procedures:
1. Mix to comply with referenced quality standards and manufacturers' written instructions.
2. Add materials, water, and additives in accurate proportions.
3. Use type of mixing equipment, speeds, containers, time, and other procedures to produce uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrate surfaces to which tile will be installed for compliance with requirements, installation tolerances and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with the Contract Documents.
3. Starting work within a particular area will be construed as acceptance.

3.2 PREPARATION

A. Substrate Cleaning: Remove curing compounds, coatings, laitance, efflorescence, concrete dust, dirt, oil, gypsum board dust, paint, and other residue that would adversely affect or reduce bonding.

B. Concrete Floor Preparation:
1. Prepare concrete floor substrates to comply with flatness tolerance of 1/4 in in 10 foot as follows:
a. Fill cracks, holes and depressions with trowelable underlayments and patching compounds.
b. Remove concrete protrusions, bumps, and ridges by sanding or grinding.
2. If substrate does not have fine broom finish, mechanically scarify concrete substrates to

not less than ICRI CSP 4 finish.

C. Substrate Joints in Showers: Apply glass-fiber tape to joints and corners of substrates within showers enclosures with thin-set mortar.

D. Blending: Verify tile has been factory blended and packaged as specified; if not, either return to manufacturer or blend tiles at site before installing.

E. Penetrations: Prior to installing tile, apply wall joint sealant at penetrations through wall substrates to create water resistant barrier; especially at piping penetrations.

3.3 INSTALLATION, GENERAL

A. Installation Quality Standard: In addition to standards listed elsewhere, perform tile work according to following, unless otherwise specified:
   1. ANSI A108 installation method indicated.
   2. TCNA installation method indicated.
   3. Respective manufacturer's written installation instructions.
   4. Approved submittals.
   5. Contract Documents.

B. General Requirements:
   1. Extend tile into recesses and under or behind equipment and fixtures to form a complete covering without interruptions unless otherwise indicated.
   2. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
   3. Accurately form intersections and returns.
   4. Perform cutting and drilling of tile without marring visible surfaces.
   5. Grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints, to form smooth edges.
   6. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile by not less than 1/8 in.

C. Jointing Pattern:
   1. Unless otherwise indicated, lay tile in grid pattern.
   2. Align joints when adjoining tiles on floor, base, walls, and trim are same size.
   3. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting.
   4. Provide uniform joint widths.
   5. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so that extent of each sheet is not apparent in finished work.

D. Wainscots: Lay out tile to next full tile beyond dimensions indicated.

3.4 TILE INSTALLATION

A. Material Installation Quality Standards: Install tile according to following standards:
   1. Medium-set Mortar: ANSI A108.5.
   2. Thin-set Mortar: ANSI A108.5.
   3. Latex-Portland Grout for Walls: ANSI A108.10.
   4. Epoxy Grout for Floors: ANSI A108.9.

B. Tile Installation Quality Standards: Install tile according to following standards:
   1. Floors: TCNA F122.
   2. Walls: TCNA W245.
   3. Shower Receptors: TCNA B420.

C. Back Buttering: For following installations, obtain minimum 95 percent mortar coverage as in referenced ANSI A108 series of installation standards:
   1. Tile floors in wet and limited water exposures.
   2. Tile floors composed of tiles 12 in by 12 in or larger.
   3. Tile floors composed of rib-backed tiles.

D. Metal Trim: Install at locations scheduled.

E. Tile and Grout Sealer: After grout has cured, apply to unglazed tile and grout joints.

3.5 MOVEMENT JOINTS

A. Floor Joints:
   1. General Requirements:

a. Continue construction, contraction (control), and expansion joints in building structure through tile work.
b. Isolate tile work that abuts a restraining structure or assembly.
c. When metal trim or sealant/backer is used for joint, width shall not be less than width of joint in building structure.
d. Tile should not be placed over building expansion joints.

2. Schedule of Products and Locations:
   a. Latex-Portland Cement Grouted Floors: Install floor joint sealant with backer rod at horizontal joints in mortar and grout setting conditions other than epoxy mortar.
   b. Epoxy Grouted Floors: Install chemical resistant floor joint sealant full depth without backer rod at horizontal joints in epoxy mortar and grout setting conditions.
3. Interior Joint Spacing:
   a. Tile Exposed to Sunlight: 8 to 12 feet on center each way.
   b. Tile Not Exposed to Sunlight: 20 to 25 feet on center each way.

3.6 CLEANING

A. Cleaning:
1. Acids are not permitted, nor will they be allowed.
2. Clean tile surfaces so they are free of foreign matter.
3. Remove grout residue from tile as soon as possible.
4. No sooner than 10 days after installation, clean grout smears and haze from tile according to tile and grout manufacturer's written instructions. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned.
5. Protect metal surfaces and plumbing fixtures from effects of cleaning.
6. Flush surfaces with clean water before and after cleaning.
7. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.

3.7 PROTECTION

A. Coverings: When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with Masonite covering during construction period to prevent staining, damage, and wear.
B. Traffic Restrictions: Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 09 5113
ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Acoustical lay-in ceiling panels, exposed suspension systems and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

B. Samples for Verification: 6 in square samples of each type, color, pattern, and texture of acoustical panel.

C. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and stabilized moisture content.

C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.4 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.

1.5 MAINTENANCE

A. Extra Materials: Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Panels: Full-size panels equal to 2.0 percent of quantity installed.
2. Suspension System Components: Quantity of each exposed component equal to 2.0 percent of quantity installed.

1.6 WARRANTY

A. Manufacturers Special Warranty: Furnish system warranty for 30 years from date of substantial completion agreeing to repair or replace defects, faulty work and failure of acoustical panels and metal suspension systems signed by an authorized representative using manufacturer's standard form.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified on Drawings and below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below.

1. Armstrong World Industries, Inc.
2. BPB USA.
3. Chicago Metallic Corporation.
4. CertainTeed Corporation.
5. Tectum Inc.
6. USG Interiors, Inc.

2.2 MATERIALS, GENERAL

A. For each ceiling type indicated, use same manufacturer for acoustical panels and metal suspension systems.

2.3 ACOUSTICAL PANELS

A. Product Quality Standard: ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances of basis of design products.

2.4 METAL SUSPENSION SYSTEMS

A. Hanger Attachments:
   1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching hanger wires and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by a qualified independent testing agency.
   2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.

B. Wire:
   1. Material Quality Standard: ASTM A 641, Class 1, zinc-coated, soft annealed, mild steel wire.
   2. Size: Select wire diameter so its stress at 3 times hanger design load, according to ASTM C 635, Table 1, "Direct Hung," will be less than yield stress of wire; but not less than 0.106 in diameter.

C. Wide-Face, Capped, Double-Web, Steel Suspension System:
   1. Description: Manufacturer's standard direct-hung metal suspension system of main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653, not less than G30 coating designation, with prefinished 15/16 in wide metal caps on flanges.
      a. Structural Classification: Heavy-duty system.
      b. End Condition of Cross Runners: Butt-edge type.
      c. Face Design: Flat, flush.
      d. Metal Cap Materials: Cold-rolled steel sheet.
      e. Metal Cap Finish: White.
   2. Basis of Design:
      a. Manufacturer: Armstrong World Industries, Inc.
      b. Product: Prelude ML.

D. Edge Moldings: Manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners.

2.5 ACCESSORIES

A. Acoustical Sealant: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates surfaces to receive acoustical ceiling system and associated work and conditions under which work will be installed.
   2. Do not proceed with installation until unsatisfactory conditions have been corrected in a manner acceptable to installer.
   3. Starting work within a particular area will be construed as applicator’s acceptance of surface conditions.

3.2 PREPARATION

A. Measure 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. Installation Quality Standards: In addition to standards listed elsewhere, comply with following, unless otherwise specified:
   1. CISCA's Ceiling Systems Handbook.
   2. ASTM C 636.
   3. Respective manufacturer's written instructions.
   4. Approved submittals.
   5. Contract Documents.

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. 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.
   4. 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 and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   5. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
   6. Do not attach hangers to steel roof deck. Attach hangers to structural members.
   7. Space hangers not more than 48 in o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 in from ends of each member.
   8. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. 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 in o.c. and not more than 3 in from ends, leveling with ceiling suspension system to a tolerance of 1/8 in in 12 ft. Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit 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 indicated on reflected ceiling plans.
   2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
   3. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
   4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

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

SECTION 09 6020
VAPOR TESTING OF CONCRETE FLOORS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Process for measuring moisture vapor emissivity from concrete floor slabs prior to floor covering installation.

1.2 PROJECT CONDITIONS

A. Maintain temperature of areas to be tested above 65 degrees F and below 100 degrees F for 48 hours before testing.

PART 2 – PRODUCTS - Not Used

PART 3 – EXECUTION

3.1 TESTING

A. Prepare concrete floor substrates according to ASTM F 710.

B. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by respective floor covering manufacturer. Do not use solvents.

C. Tests:

1. Bond: Perform test using plastic sheet method according to ASTM D 4263. If approved by Architect, respective floor covering manufacturer's standard mat bond test is acceptable in lieu of plastic sheet method.
2. Alkalinity Testing: Perform test to measure pH according to method indicated in ASTM F 710. Unless required otherwise by respective floor covering manufacturer, pH shall be between 8 and 10.
3. Moisture Testing: Perform test according to one of following methods:
   a. Anhydrous calcium chloride test according to ASTM F 1869. Unless required otherwise by respective floor covering manufacturer, moisture vapor transmission rate shall be not more than 5 lb/1000 sq ft in 24 hrs.
   b. Relative humidity test using in situ probes according to ASTM F 2170. Unless required otherwise by respective floor covering manufacturer, relative humidity shall be not more than 75 percent.

D. Proceed with floor covering installation only after substrates pass testing and substrate is acceptable to respective manufacturer.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 09 6513
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Resilient wall base and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's written installation instructions.

B. Samples for Verification: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 in long, of each resilient product color, texture, and pattern required.

1.3 MAINTENANCE

A. Extra Materials: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed and that are packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified on Drawings and below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

1. Resilient Molding - Carpet Tile to Polished Concrete Floor:
    a. Manufacturer: Forbo Flooring Systems
    b. Product: ACC13.

2.2 MATERIALS

A. Resilient Base:

1. Product Quality Standard: ASTM F 1861, Type TS or TP, Group I or II.
2. Style: Cove (base with toe) at resilient flooring; straight (flat or toeless) at carpet.
3. Minimum Thickness: 0.125 in.
4. Height: 4 in.
5. Lengths: Coils in manufacturer's standard length.
6. Outside Corners: Job formed.
7. Inside Corners: Job formed.

B. Resilient Moldings: Carpet edge at polished concrete flooring.

1. Material: Rubber.
2. Profile and Dimensions: As required by conditions.
3. Finish, Colors, and Patterns: Same as for resilient base.

2.3 ACCESSORIES

A. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to which resilient base and accessories will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. Respective manufacturer's installation instructions.

2. Approved submittals.
3. Contract Documents.

B. Do not install resilient products until they are same temperature as the space where they are to be installed. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

3.3 RESILIENT BASE INSTALLATION

A. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

B. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

C. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

D. Do not stretch resilient base during installation.

E. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 RESILIENT MOLDING INSTALLATION

A. Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.5 CLEANING

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products; remove adhesive and other blemishes from exposed surfaces.

3.6 PROTECTION

A. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

END OF SECTION

SECTION 09 6566
RUBBER FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Adhered sheet rubber flooring and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

B. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed sheet rubber athletic flooring installations similar in material, design, and extent to that indicated for this Project, who is acceptable to manufacturer, and whose work has resulted in installations with a record of successful in-service performance.

1.4 PROJECT CONDITIONS

A. Install products after other finishing operations, including painting, are completed.

B. Maintain a temperature of not less than 70 deg F or more than 95 deg F in installation spaces for at least 48 hours before installation, during installation, and for at least 48 hours after installation, unless manufacturer's written recommendations specify longer time periods. After postinstallation period, maintain a temperature of not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during flooring installation and for time period after installation recommended in writing by manufacturer.

1.5 MAINTENANCE

A. Extra Materials: Furnish not less than 5 percent of amount installed of each type, color, pattern, and size of sheet flooring installed packaged with protective covering for storage and identified with labels describing contents.

PART 2 - PRODUCTS

2.1 MANUFACTURER AND PRODUCTS

A. Basis of Design: Contract Documents are based on products specified on Drawings to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

2.2 MATERIALS

A. Rubber Flooring: Composition of recycled truck tire crumb rubber encapsulated in a urethane binder, not less than 3/8 inch thick, 48 inch wide rolls.

B. Minimum Physical Properties:

1. Hardness: 65 Shore A according to ASTM D 2240.
2. Slip Resistance: Exceeds ADA recommendations according to ASTM D 2047.
3. Abrasion Loss: Less than 1 gram according to ASTM D 3389.
4. Flammability: Pass pill test according to ASTM D 2859.

2.3 ACCESSORIES

A. Trowelable Leveling and Patching Compound: Latex-modified, hydraulic-cement-based formulation approved by flooring manufacturer.

B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive rubber flooring and associated work for compliance with

requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Prepare substrates according to following:
1. Manufacturer's written instructions.
2. ASTM F 710.

B. Remove coatings, including curing compounds, sealers, hardeners, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer; do not use solvents.

C. Test substrates according to Section 09 6020 - Vapor Testing of Concrete Floors.

D. Prepare substrates to comply with flatness tolerance of 1/4 in in 10 foot as follows:
1. Fill cracks, holes and depressions with trowelable leveling and patching compounds.
2. Remove concrete protrusions, bumps, and ridges by sanding or grinding.

E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
1. Respective manufacturer’s installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Lay out sheet flooring to comply with the following requirements:
1. Maintain uniformity of flooring direction.
2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 inches from parallel joints in flooring substrates.
3. Match edges of sheet flooring for color shading and pattern at seams.
4. Avoid cross and butt seams.

C. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

D. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.

E. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers' written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

F. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

G. Restrict foot traffic at least 12 hours after installation. Restrict rolling traffic for 24 hours after installation. Do not clean floor for 5 days.

H. Floor Finish: Apply finish coats as recommended by manufacturer.

3.4 CLEANING

A. Perform the following operations immediately after installing flooring products:
1. Remove adhesive and other surface blemishes using cleaner recommended in writing by flooring manufacturer.
2. Sweep and vacuum floor thoroughly.
3. Do not wash floor until after waiting period recommended in writing by flooring manufacturer.
4. Damp mop floor to remove marks and soil using method and cleaner recommended in writing by flooring manufacturer.

3.5 PROTECTION

A. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

Use protection methods indicated or recommended in writing by flooring manufacturer.

B. Do not move heavy or sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 09 6813
TILE CARPETING

PART 1 - GENERAL
1.1 SUMMARY
A. Section Includes: Modular carpet tile and accessories indicated, specified, or required for installation.
1.2 SUBMITTALS
A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's written installation instructions.
B. Samples for Verification: Not less than 6 by 9 inch sections for each color and pattern of carpet tile required.
C. Maintenance Data: For inclusion in maintenance manual required by Division 01.
1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.
1.3 QUALITY ASSURANCE
A. Installer Qualifications: Certified by Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
1.4 DELIVERY, STORAGE, AND HANDLING
A. Comply with CRI 104, Section 5.
1.5 PROJECT CONDITIONS
A. General: Comply with CRI 104, Section 6.1.
1.6 WARRANTY
A. Special Manufacturer's Warranty: Standard form in which manufacturer agrees to replace carpet tile that does not comply with requirements or that fails within 10 years from date of substantial completion. Warranty does not include deterioration or failure of carpet tile from unusual traffic, failure of substrate, vandalism, or abuse.
B. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
1.7 MAINTENANCE
A. Extra Materials: Furnish extra materials equal to 5 percent of amount installed for each type indicated, but not less than 10 sq yd that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
PART 2 - PRODUCTS
2.1 MANUFACTURERS
A. Basis of Design: Contract Documents are based on products specified on Drawings to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change concept expressed in Contract Documents as judged by Architect.
2.2 CARPET TILE
A. Carpet Tile: Products that are equivalent to color, texture, pattern, finish, appearance, and material quality characteristics indicated by basis of design selection.
2.3 ACCESSORIES
A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
B. Adhesives: Water-resistant type recommended by manufacturer to suit floor covering and substrate conditions indicated.
PART 3 - EXECUTION
3.1 EXAMINATION
A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which carpet tile will be applied for compliance with requirements and other conditions affecting performance.

2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

B. Verify that finishes of substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor coverings.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions.

B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.

C. Test substrates according to Section 09 6020 - Vapor Testing of Concrete Floors.

D. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

E. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

F. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
1. CRI 104, Section 14.
2. Respective manufacturer’s installation instructions.
3. Approved submittals.
4. Contract Documents.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye lot integrity. Do not mix dye lots in same area.

D. Cut and fit to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by manufacturer.

E. Extend into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.

G. Install pattern parallel to walls and borders.

H. CLEANING

I. Comply with manufacturer's written instructions for cleaning and protection.

J. Perform following operations immediately after completing installation:
1. Remove adhesive and other blemishes.
2. Sweep and vacuum thoroughly.

3.4 PROTECTION

A. Protect from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

B. Cover until substantial completion.

END OF SECTION

SECTION 09 8433
ACOUSTICAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fabric wrapped, back mounted, acoustical wall panels, and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's written installation instructions.

B. Shop Drawings: Detailed and dimensioned plans, elevations and large-scale details showing panel layout and related junctions with other work or finishes, and interrelation of mechanical and electrical items related to system.

C. Samples for Verification: 12 by 12 inch in size illustrating material, construction, and finish of units.

D. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experience: Company with not less than 3 years experience in performing specified work similar in design, products, and extent to scope of this Project; with a record of successful in-service performance; and with sufficient production capability, facilities, and personnel to produce required Work.
2. Supervision: Maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.

1.4 PROJECT CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F and humidity of 20 to 40 percent prior to, during and after installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products named below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and does not change concept expressed in Contract Documents as judged by Architect.

1. Manufacturer: Decoustics; Saint Gobain.
2. Panel Type: Acoustical Wall Panel, AP.
3. Unbacked Fabric: As indicated on Drawings.

2.2 MATERIALS

A. Core Material: ASTM C 612, Type IA or Types IA and IB glass-fiber board, 4 to 7 lb/cu. ft. density, unfaced, dimensionally stable, molded rigid board, with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

B. Fabric Facing Material: Products that matches color, texture, pattern, and material quality characteristics indicated by basis of design selection.

2.3 MOUNTING OPTIONS

A. Back-Mounting Devices: One of following, concealed on backside of panel, designed to allow for panel removal:

1. Hook-and-loop tape.
2. Impaling clips.
3. Magnetic strip or devices.
4. Two-part metal Z-shaped clips, with one part of each clip mechanically attached to back of panel and the other part to wall substrate.

2.4 FABRIC WRAPPED PANEL FABRICATION

A. Panel Description: Manufacturer's standard panel construction consisting of facing material adhered to front face, edges, and back border of core; with edges chemically hardened to reinforce panel perimeter against warpage and damage.
   1. Size: As indicated on Drawings.
   2. Thicknesses: 2 inches.
   3. Panel Edge Detail: Chamfered.
   4. Corner Detail: Square to form continuous profile to match edge detail.

B. Fabric Facing: Stretched straight, on grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other foreign matter; with tailored corners.

C. Fabrication Tolerances: Plus or minus 1/16 inch for following:
   1. Thickness.
   2. Edge straightness.
   3. Overall length and width.
   4. Squareness from corner to corner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive acoustical wall panels and associated Work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer’s installation instructions.
   2. Approved submittals.
   3. Contract Documents.

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

C. Match and level fabric pattern and grain among adjacent panels.

D. Installation Tolerances:
   1. Variation from Level and Plumb: Plus or minus 1/16 inch.
   2. Variation of Panel Joints from Hairline: Not more than 1/16 inch wide.

3.3 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels with fabric facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, to ensure that acoustical wall panels are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09 9100
PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Surface preparation and field painting of exposed exterior and interior items and surfaces.

1.2 DEFINITIONS

A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
   1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
   2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
   3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
   4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

1.3 SUBMITTALS

A. Product Data: Manufacturers technical literature for each paint system indicated, specified, or required.
   1. Indicate each material and cross-reference specific coating, finish system, and application.
   2. Identify each material by manufacturer's catalog number and general classification.
   3. Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.

B. Detailed Painting Schedule:
   1. Furnish "Detailed Painting Schedule" indicating type of surface, type of paint material, and number of coats required, as set forth in "Painting Requirements".
   2. Submit brand designation and grade of indicated type produced by approved manufacturer for each application listed or required.

C. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative samples of the actual substrate, 8 by 10 inches.
   1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
   2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and field applied primers for each coating system from the same manufacturer as the finish coats.

C. Field Samples (Mockups): Provide a full-coat benchmark finish sample for each type of coating and substrate required. Duplicate finish of approved sample Submittals.
   1. Select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
      a. Wall Surfaces: Provide samples on at least 100 square feet.
      b. Small Areas and Items: One item or area required.
   2. Apply samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
      a. After finishes are accepted, surface will be used to evaluate coating systems of a similar nature.
   3. Final approval of colors will be from field samples.

1.5 DELIVERY AND STORAGE

A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature recommended by manufacturer. Maintain storage containers in a clean condition, free of foreign materials and residue.

1.6 FIELD CONDITIONS

A. Apply paints only when temperatures of surfaces to be painted and surrounding air are between minimum and maximum range recommended by manufacturer.

B. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature and humidity limits specified by manufacturer during application and drying periods.

1.7 MAINTENANCE

A. Extra Materials: Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

1. Quantity: Furnish the Owner with an additional 3 percent, but not less than 1 gallon or 1 case, as appropriate, of each material and color applied.
2. Label each container with color, color number, texture and room locations, in addition to manufacturer's label.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products manufactured by Sherwin-Williams Co. to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide products by one of manufacturers listed alphabetically below.

1. Benjamin Moore & Co.
2. Glidden Professional.
3. Kelly-Moore Paints.
4. Kwal Paint.
5. PPG Architectural Finishes, Inc.
6. Sherwin-Williams Co.

2.2 PAINT MATERIALS, GENERAL

A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with 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 “Consumer Line” paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Except where noted, manufacturer’s “Professional Line” products are NOT acceptable. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. 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 listed acceptable manufacturers.

D. Products: As indicated in PART 3.

E. Colors: As indicated on Drawings.

2.3 TEXTURE MATERIALS

A. Wall Texture:

1. Description: Unaggregated, water-based, ready mix, sprayable vinyl formulation to create textured finish.
2. Basis of Design: USG Corp.; Sheetrock Wall and Ceiling Spray Texture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive paint and associated Work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting Work within a particular area will be construed as acceptance of surface conditions.

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 shop applicators to ensure use of compatible primers.

3.2 PREPARATION

A. General:
   1. Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted.
   2. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
   3. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

B. Surface Preparation: Prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition. Clean substrates of substances that could impair the bond of the various coatings.
   1. Gypsum Board: Comply with Gypsum Association Publication GA 232.
      a. Fill remaining cracks, depressions, holes and other irregularities with spackling compound.
      b. Sand rough or high spots left by joint cement or spackling compound without damaging paper face.
      c. Remove dust by wiping with damp cloths or vacuuming.
   2. Ungalvanized Metal Surfaces:
      a. Clean surfaces that have not been shop coated to remove foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
      b. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with same primer as the shop coat.
   3. Galvanized Metal Surfaces:
      a. Clean galvanized surfaces free of oil and surface contaminants.
      b. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

C. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
   1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
   2. Use only thinners approved by paint manufacturer and only within manufacturer’s recommended limits.

D. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of 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, GENERAL

A. 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 indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated,

Architect will select from standard colors and finishes available.

C. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
   1. Prefinished items include the following factory-finished components:
      a. Prefinished wood doors.
      b. Acoustical materials.
      c. Prefinished architectural woodwork and cabinets.
   2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
      a. Furred areas.
      b. Ceiling plenums.
      c. Pipe spaces.
   3. Finished metal surfaces.
   4. Finished mechanical and electrical operating equipment.
   5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

3.4 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 paint 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. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces.
   5. Before 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. Sand lightly between each succeeding enamel coat on metals.
   10. Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation.
   11. The number of coats and film thickness required are the same regardless of application method.
   12. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
   13. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
   14. Omit primer over metal surfaces that have been shop primed and touchup painted.
   15. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
   16. Ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
   17. Allow sufficient time between successive coats to permit proper drying.

B. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve total dry film thickness of the entire system as recommended by manufacturer.

C. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by 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.

D. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

E. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.

F. Texture Finish: Apply using powered spray equipment to product specified textured finish free of starved spots or other evidence of thin application or of application patterns.

G. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.5 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop primed equipment. Paint shop pre-finished items where exposed to view in finished spaces. In mechanical rooms, repair shop pre-finished coatings which have been scratched or otherwise damaged with identical touch-up paint. Sand prior to touching up as required.

B. Paint exposed ductwork and piping.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Paint grilles, registers, and diffusers to match adjacent wall and ceiling surfaces, except that factory-pre-finished items need not be painted.

E. In finished spaces, prime and paint exposed pipes, conduit, boxes, ducts, hangers, brackets, collars and supports. Paint to match adjacent surfaces.

F. Repair or replace identification markings on mechanical or electrical equipment when painted accidentally.

G. Paint surfaces of plywood backboards for electrical and telephone equipment before installing equipment.

H. Replace electrical plates, hardware, light fixture trim, and fittings removed prior to finishing.

I. Paint exposed air handlers, roof ventilators, goose necks, exhaust fans and other items on roof with 1 coat (or as otherwise required to cover) exterior enamel. Prepare surfaces in accordance with the base metal or primer as specified herein.

3.6 CLEANING

A. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

3.7 PROTECTION

A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repainting, repairing or replacing. Coordinate corrections with other trades involved.

B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.8 INTERIOR PAINT SCHEDULE

A. Gypsum Board Walls – Eggshell Latex Finish:
   1. 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W500.
   2. 2nd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series.
   3. 3rd Coat: S-W Harmony Low Odor Interior Latex Eg-Shel, B9 Series.

B. Gypsum Board Ceilings and Soffits – Flat Latex Finish:
   1. 1st Coat: S-W Harmony Low Odor Interior Latex Primer, B11W500.
   2. 2nd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series.
   3. 3rd Coat: S-W Harmony Low Odor Interior Latex Flat, B5 Series.

C. Primed Ferrous Metal and Hollow Metal Doors and Frames – Semi-Gloss Acrylic Finish:
   1. 1st Coat: S-W ProCryl Universal Primer, B66-310 Series.
   2. 2nd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series.
   3. 3rd Coat: S-W ProClassic Waterborne Acrylic Semi-Gloss, B31 Series.

3.9 EXTERIOR PAINT SCHEDULE

A. Galvanized Ferrous Metal – Semi-Gloss Acrylic Finish:
   1. 1st Coat: S-W ProCryl Universal Primer.

2. 2nd Coat: S-W DTM Acrylic B66W00111.
3. 3rd Coat: S-W DTM Acrylic B66W00111.

B. Primed Ferrous Metal – Satin Acrylic Finish:
1. 1st Coat: S-W ProCryl Universal Primer, B66-310 Series.
2. 2nd Coat: S-W Exterior Satin Acrylic Latex, A100 Series.
3. 3rd Coat: S-W Exterior Satin Acrylic Latex, A100 Series.

END OF SECTION

SECTION 10 1416
DEDICATION PLAQUE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Cast metal plaque and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include manufacturer's written installation instructions.

B. Shop Drawings: Detailed and dimensioned elevations, large scale details, and attachments to other work.

C. Template: Submit full-size template drawing indicating letter size, stock, spacing, and fasteners.

PART 2 - PRODUCTS

2.1 DEDICATION PLAQUE

A. Cast Dedication Plaque: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to receive dedication plaque and associated work for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. Respective manufacturer's installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Install plumb, level and square and in proper planes with other work, at heights as indicated.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 10 1419
DIMENSIONAL LETTER SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Exterior, dimensional letter signage and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each type of product indicated, specified, or required. Include manufacturer's installation instructions.

B. Shop Drawings:

1. Show fabrication and installation details for signs.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

B. Aluminum Castings: ASTM B 26, alloy and temper recommended by sign manufacturer for casting process used and for type and use and finish indicated.

2.2 DIMENSIONAL CHARACTERS

A. Fabricated Channel Characters: Metal face and side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability and for securing fasteners; concealed stud mounting.

2.3 FABRICATION

A. Shop Fabrication: Manufacturer's standard sign assemblies according to requirements indicated.

1. Mill joints to tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
2. Internally brace signs for stability and for securing fasteners.

2.4 ALUMINUM FINISHES

A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved samples and are assemblied or installed to minimize contrast.

B. Dark Bronze Anodized Aluminum Finish:

1. Finish Quality Standard: AA-M12C22A42/A44 to comply with AAMA 611
2. Coating: Architectural Class I not less than 0.7 mils thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:

1. Examine substrates to which dimensional letter signage will be applied for compliance with requirements, installation tolerances and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:

1. Respective manufacturer's written installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Dimensional Characters: Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions.

1. Provide heavy paper template to establish character spacing and to locate holes for

fasteners.

2. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
3. Use nonremovable mechanical fasteners placed through predrilled holes. Attach signs with fasteners and anchors suitable for secure attachment to substrate as recommended in writing by sign manufacturer.

END OF SECTION

SECTION 10 2113
TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Ceiling mounted toilet compartments and wall mounted urinal screens with stainless steel facings, and accessories indicated, specified, or required to complete installation.

1.2 DELEGATED ENGINEERING REQUIREMENTS

A. Delegated Engineering Responsibility: Employ delegated engineering professional to provide engineering for structural support, including attachment to building structural frame, required to comply with concept expressed in Contract Documents.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
   1. Include manufacturer's written installation instructions.
   2. Include installation details, material descriptions, dimensions of individual components and profiles.

B. Shop Drawings: Detailed and dimensioned plans, elevations, sections, details, and attachments to other work.
   1. Show locations of cutouts for compartment-mounted toilet accessories.
   2. Show locations of reinforcements for compartment-mounted grab bars.
   3. Show locations of centerlines of toilet fixtures.
   4. Design and show overhead support.

C. Samples for Verification: 6 inch square of stainless steel finish.

D. Maintenance Data: For inclusion in maintenance manual required by Division 01.
   1. Include manufacturer's instructions for maintenance of installed work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
   2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.
   3. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with applicable provisions for toilet compartments designated as accessible.

B. Delegated Engineering Professional Qualifications: Professional engineer legally authorized to practice in jurisdiction where Project is located and experienced in providing engineering services of kind indicated that have resulted in installations similar to this Project, and, that has a record of successful in-service performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into work include, but are not limited to, those listed alphabetically below.
   1. Accurate Partitions Corporation.
   2. American Sanitary Partition Corporation
   3. Bobrick Washroom Equipment, Inc.
   4. Capitol Partitions, Inc.
   5. Global Steel Products Corp.
   6. Hadrian, Inc.
   7. Metpar Corp.

2.2 PRIMARY MATERIALS

A. Metal: ASTM A 666, Type 304 stainless steel sheet, leveled to stretcher leveled flatness, with No. 4 non-directional finish.

B. Core Material: Manufacturer's standard sound-deadening honeycomb of resin-impregnated kraft paper in thickness required to provide finished thickness of 1 inch for doors and panels and

1-1/4 inches for pilasters.

C. Zamac: ASTM B 86, commercial zinc-alloy die castings with chrome plating.

2.3 CONSTRUCTION

A. Door, Panel, Pilaster, and Screen Panels:
   1. Facing sheets free of pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections.
   2. Seamless, metal facing sheets pressure laminated to core material with continuous, interlocking molding strip or lapped and formed edge closures.
   3. Corners sealed by welding with welds ground smooth.
   4. Concealed internal reinforcement for grab bars mounted on units.

B. Pilaster Shoes and Sleeves: Manufacturer's standard two-piece collars, 3 inches high.

C. Stirrup Brackets: Manufacturer's standard ear or U-brackets for attaching panels and screens to walls and pilasters of chrome-plated, nonferrous, cast zinc alloy.

2.4 ACCESSORIES

A. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories.
   1. Material: Chrome-plated zamac or stainless steel.
   2. Hinges: Manufacturer's standard continuous, cam type that swings to a closed or partially open position.
   3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
   4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
   5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors.
   6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.

B. 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.

2.5 FABRICATION

A. Ceiling-Hung Units: Manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

B. Door Size and Swings: 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 designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive toilet compartment and associated work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer’s installation instructions.
   2. Approved submittals.

3. Contract Documents.

B. Installation, General: Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
   1. Maximum Clearances:
      a. Pilasters and Panels: 1/2 inch.
      b. Panels and Walls: 1 inch.
   2. Stirrup Brackets: Secure panels to walls and to pilasters with not less than two brackets attached near top and bottom of panel.
      a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
      b. Align brackets at pilasters with brackets at walls.

C. Ceiling-Hung Units: Secure pilasters to supporting structure and level, plumb, and tighten. Hang doors and adjust so bottoms of doors are level with bottoms of pilasters when doors are in closed position.

D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

A. Hardware Adjustment: Adjust and lubricate hardware according to manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 10 2619
CORNER GUARDS

PART 1 - GENERAL
1.1 SUMMARY
A. Section Includes: Stainless steel corner guards accessories indicated, specified, or required to complete installation.
1.2 SUBMITTALS
A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
PART 2 - PRODUCTS
2.1 CORNER GUARDS
A. Material and Fabrication: ASTM A 240, Type 304, minimum 0.050 inch thick stainless steel with satin No. 4 non-directional finish; formed to fit wall condition.
1. Wing Size: Nominal 1-1/2 by 1-1/2 inches.
2. Height: 48 inches above base.
3. Corner Radius: 1/8 inch.
4. Mounting: Double-faced, adhesive foam tape.
PART 3 - EXECUTION
3.1 EXAMINATION
A. Acceptance of Surfaces and Conditions:
1. Examine substrates to which corner guards will be applied for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting work within a particular area will be construed as acceptance of surface conditions.
3.2 INSTALLATION
A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
1. Respective manufacturer's installation instructions.
2. Approved submittals.
3. Contract Documents.
B. Install level, plumb, and true to line without distortions.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 10 2813
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Toilet and bath accessories and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on products specified under each item below to establish a standard of quality. Other acceptable manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Products:

1. Drawing Designation A - Waste Receptacle:
    a. Basis of Design Product: Bobrick, B-43644.
    b. Mounting: Semi-recessed.
    c. Material: Stainless steel.
    d. Accessories: Reusable waste-receptacle liner.
2. Drawing Designation C - Toilet Tissue Dispenser:
    a. Basis of Design Product: Bobrick, B-2888.
    b. Mounting: Surface mounted with concealed anchorage.
    c. Material: Stainless steel.
    d. Lockset: Tumbler.
    e. Operation: Noncontrol delivery with standard spindle.
    f. Capacity: Designed for 2 standard diameter-core tissue roll.
3. Drawing Designation D - Mirror: Specified in Section 08 8300 - Mirrors.
4. Drawing Designation E - Grab Bars:
    a. Basis of Design Product: Bobrick, B6806 x 36 inch length and 42 inch length,
    b. Material: Stainless steel, 0.05 inch thick.
    c. Mounting: Concealed.
    d. Gripping Surfaces: Smooth, satin finish.
    e. Outside Diameter: 1-1/2 inches.
5. Drawing Designation G - Towel-Robe Hook:
    a. Basis of Design Product: Bobrick, B-2116
    b. Mounting: Surface mounted, with wall backplate for concealed mounting.
6. Drawing Designation J - Shower Curtain, Hooks, and Rod:
    a. Curtain:
        1) Basis of Design Product: J. Shrone's Inc.
        2) Material: 200 denier, 100 percent nylon with anti-fungus and mildew resistant treatment; fully hemmed bottom and side hems; reinforced top header hem.
        3) Grommets: Corrosion-resistant at minimum 6 inches o.c. through top hem.
        4) Size: 54 inches wide by 84 inches high.
        5) Color: White.
    b. Hooks:
        1) Basis of Design Product: Bobrick; B-204-1.
        2) Material: Chrome-plated or stainless-steel, spring wire curtain hooks with snap fasteners, sized to accommodate specified curtain rod; one hook for each curtain grommet.
    c. Rod:
        1) Basis of Design Product: Bobrick; B-6047.

2) Rod Material: Type: Heavy-duty, 1-1/4 inch OD; fabricated from nominal 0.05 inch thick stainless steel, in length required for shower opening indicated.
3) Flange Material: 3 inch stainless-steel flanges designed for exposed fasteners.

7. Drawing Designation K - Broom-Mop Holder-Shelf:
   a. Basis of Design Product: Bobrick, B-224 x 36.
   b. Material: Stainless steel.
   c. Length: 36 inches.
   d. Shelf: 0.05 inch thick stainless steel.
   e. Hooks: Three.
   f. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
   g. Rod: Approximately 1/4 inch diameter, stainless-steel rod suspended beneath shelf.
8. Drawing Designation O - Waste Receptacle:
   a. Basis of Design Product: American Specialties Inc., 9474.
   b. Mounting: Recessed.
   c. Material: Stainless steel.
   d. Accessories: Reusable waste-receptacle liner.
9. Drawing Designation P - Sanitary Napkin Disposal Units:
   a. Basis of Design Product: Bobrick, B-254.
   b. Mounting: Surface.
   c. Material: Stainless steel.
10. Drawing Designation Q - Waste Receptacle:
    a. Basis of Design Product: Bobrick, B-277.
    b. Mounting: Surface.
    c. Material: Stainless steel.
    d. Accessories: Reusable waste-receptacle liner.

C. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents, provide product by one of manufacturers listed alphabetically below.
1. Toilet Accessories:
   a. Bobrick Washroom Equipment, Inc.
   b. American Specialties, Inc.
   c. Bradley Corporation.
   d. General Accessory Manufacturing Co. (GAMCO).
   e. McKinney/Parker Washroom Accessories Corp.
2. Shower Curtains:
   a. Barjan Manufacturing Ltd.
   b. Brite Inc.
   c. Gary Manufacturing.
   d. J. Shrone's Inc.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, No. 4 non-directional finish, 0.0312 inch minimum nominal thickness, unless otherwise indicated.
B. Steel Sheet: ASTM A 366, 0.0359 inch minimum nominal thickness.
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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to receive toilet and bath accessories and associated Work for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface

conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Install accessories using fasteners appropriate to substrate indicated and recommended by unit manufacturer.

C. Install units level, plumb, and firmly anchored in locations and at heights indicated.

D. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.

E. Adjust accessories for unencumbered, smooth operation and verify that mechanisms function properly. Replace damaged or defective items. Remove temporary labels and protective coatings.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 10 4400
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fire protection specialties, including cabinets, portable fire extinguishers, and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
   1. Cabinets: Include door hardware, cabinet type, trim style, panel style, and details of installation.
   2. Fire Extinguishers: Include rating and classification.

1.3 QUALITY ASSURANCE

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10.

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

1.4 WARRANTY

A. Special Manufacturer's Warranty: Standard form in which manufacturer agrees to repair or replace components of portable fire extinguishers that fails in materials or workmanship within 6 years from date of substantial completion.

B. Failures include, but are not limited to, the following:
   1. Failure of hydrostatic test according to NFPA 10.
   2. Faulty operation of valves or release levers.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Stainless Steel Sheet: ASTM A 666, Type 304.

B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE EXTINGUISHERS

A. General: Type, size, and capacity for each fire protection cabinet indicated.
   1. Valves: Manufacturer's standard.
   2. Handles and Levers: Manufacturer's standard.
   3. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B and bar coding for documenting fire extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type: Monoammonium phosphate-based dry chemical in enameled-steel container; size as indicated on Drawings.

2.3 CABINETS

A. Type: Nonrated, suitable for fire extinguisher and wall construction.

B. Exposed Metal: Stainless steel sheet.

C. Recessed Cabinets:
   1. Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
   2. One-piece combination flat trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend) of 1/4 to 5/16 inch.

D. Door:
   1. Style: Vertical duo panel with frame.
   2. Glazing: Tempered clear float glass.

E. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   1. Provide projecting door pull and friction latch.
   2. Provide continuous hinge, of same material and finish as trim, permitting door to open 180 degrees.

2.4 FABRICATION

A. Cabinets: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth.
B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
   1. Fabricate door frames with tubular stiles and rails and hollow metal design, minimum 1/2 inch thick.
   2. Miter and weld perimeter door frames.
C. Cabinet Trim: Fabricate flat cabinet trim in one piece with corners mitered, welded, and ground smooth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive fire protection specialties and associated Work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 PREPARATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

3.3 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer’s installation instructions.
   2. Approved submittals.
   3. Contract Documents.
B. Install fire-protection specialties in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
C. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
   1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semi-recessed fire-protection cabinets.
   2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.

END OF SECTION

SECTION 10 4463
FIREMAN'S KEY KEEPER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Fireman's key keeper and accessories indicated, specified, or required to complete installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Contract Documents are based on following manufacturer and product to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.
   1. Manufacturer: Knox Co.
   2. Product: 3200 Surface Mount.

2.2 COMPONENT CONSTRUCTION

A. Key Cabinet: Surface mount 1/4 inch thick steel plate housing with 1/2 inch thick steel plate hinged door with interior gasket seal and stainless steel door hinge; 1/8 inch thick stainless steel dust cover with tamper seal mounting capability; 4 inches high by 5 inches wide by 3-3/4 inches deep; UL listed double action lock with rotating tumblers and hardened steel pins accessed by a biased cut key; black powder coated finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to which fireman's key keeper will be installed for compliance with requirements, installation tolerances and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following:
   1. Respective manufacturer's written installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Set accurately in position and attach securely to supports with mechanical noncorrosive fasteners.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 11 3113
KITCHEN APPLIANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Residential type kitchen appliances and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.
   1. Include manufacturer's written installation instructions.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Operation and Maintenance Data: For inclusion in operations and maintenance manual required by Section 01 7700 – Closeout Procedures.
   1. Include manufacturer's instructions for operation and maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
   2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled, as defined in NFPA 70, Article 100, by UL or another testing agency acceptable to authorities having jurisdiction; and marked for intended use.

B. Gas-Burning Appliances: Comply with ANSI Z21 Series standards.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design Product: Contract Documents are based on products specified below to establish a standard of quality. Other available manufacturers with products having equivalent characteristics may be considered, provided deviations are minor and design concept expressed in Contract Documents is not changed, as judged by Architect.

B. Microwave Oven:
   1. Manufacturer: General Electric Co.
   2. Model: Profile Series, PEB7226SFSS.

C. Gas Range:
   1. Manufacturer: Viking Professional.
   2. Model: VGSC548-6G; six-burner/griddle range.
   3. Accessories:
      a. 8 inch backguard; P48BG8.
      b. Countertop side trim; P24CST.

D. Dishwasher:
   1. Manufacturer: General Electric Co.
   2. Model: GTD580SSFSS.

E. Garbage Disposal:
   1. Manufacturer: General Electric Co.
   2. Model: GFC1020V.
   3. Capacity: 1 HP continuous feed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive kitchen appliances and associated Work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.

3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's written installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. Set appliances in final locations after finishes have been completed; verify clearances are adequate to properly operate equipment; connect to utilities.

END OF SECTION

SECTION 12 2113
HORIZONTAL LOUVER BLINDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Aluminum louver slat blinds and accessories indicated, specified, or required for installation at window.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required.

B. Samples for Initial Selection: Full range of standard manufacturer's colors available, on samples of sheet metal with factory-applied color finishes.

C. Maintenance Data: For inclusion in maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.
3. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

1.3 QUALITY ASSURANCE

A. Corded Window Covering Product Standard: WCMA A 100.1, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents, manufacturers offering products that may be incorporated into Work include, but are not limited to, those listed alphabetically below.

1. Levolor Contract; Riviera.
2. Hunter Douglas Window Fashions.
3. Springs Window Fashions Division, Inc.; Bali.

2.2 HORIZONTAL LOUVER BLINDS

A. Louver Slats: Aluminum, alloy and temper recommended by producer for type of use and finish indicated; with crowned profile and radiused corners.

1. Nominal Slat Width: 1 inch.
2. Slat Spacing: Manufacturer's standard.
3. Nominal Slat Thickness: Not less than 0.006 inch.

B. Headrail: Formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends.

C. Headrail/Valance: Decorative, integrated headrail/valance not requiring a separate valance or end brackets for finished appearance; formed steel or extruded aluminum; long edges returned or rolled; fully enclosing operating mechanisms on three sides and ends.

D. Bottom Rail: Formed-steel or extruded-aluminum tube, sealed with plastic or metal capped ends; with enclosed and protected ladders and tapes to prevent their contact with sill.

1. Top contoured to match crowned shape of louver slat.
2. Bottom contoured for minimizing light gaps.

E. Tilt Control: Enclosed worm gear mechanism, slip clutch or detachable wand preventing overrotation, and linkage rod.

1. Tilt Operation: Manual with clear plastic wand.
2. Length of Tilt Control: Length required to make operation convenient from floor level.
3. Tilt: Two-direction, positive stop or lock out limited at an angle of 60 degrees from zero degree horizontal, both directions.

F. Lift Operation: Manual, cord lock; locks pull cord to stop blind at any position in ascending or descending travel.

G. Tilt-Control and Cord-Lock Position: As indicated.

H. Ladders: Braided string evenly spaced to prevent long-term louver sag.

I. Valance: Two louver slats.

J. Mounting: End permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated.
   1. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

K. Finish: Ionized coating; antistatic, dust-repellent, baked polyester.
   1. Headrails/Valances: Match louver slats as indicated.
   2. Component Color: Rails, cords, ladders, and exposed-to-view metal and plastic matching or coordinating with slat color.
   3. Finish: As selected from manufacturer's full range available.

2.3 ACCESSORIES

A. Fasteners: Type, diameter, material thicknesses, and lengths sufficient to attach or anchor item to substrate indicated without failure.

2.4 FABRICATION

A. Fabrication Product Standard: AWCMA 1029, unless otherwise indicated.

B. Concealed Components: Non-corrodible or corrosion-resistant-coated materials.

C. Lifting and Tilting Mechanisms: With permanently lubricated moving parts.

D. Unit Sizes: Fabricated in sizes to fill window between (inside) jambs, measured at 74 degrees F:
   1. Width: Equal to 1/4 inch per side or 1/2 inch total, plus or minus 1/8 inch, less than jamb-to-jamb dimension of opening in which each blind is installed.
   2. Length: Equal to 1/4 inch, plus or minus 1/8 inch, less than head-to-sill dimension of opening in which each blind is installed.

E. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.

F. Installation Fasteners: Not fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
   1. Examine substrates to receive horizontal louver blinds and associated Work for compliance with requirements and other conditions affecting performance.
   2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
   3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
   1. Respective manufacturer's installation instructions.
   2. Approved submittals.
   3. Contract Documents.

B. General Requirements:
   1. Install level and plumb and aligned with adjacent units according to manufacturer's written instructions.
   2. Install intermediate support as required to prevent deflection in headrail.

3.3 ADJUSTING

A. Adjust horizontal louver blinds to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 SCHEDULE

A. Locations:
   1. Room 105 - Training: At each Type A Window, one blind unit mounted outside of window frame, overlap full width of mullions.

2. Room 112 - Office: At Type D Window, one blind unit mounted outside of window frame, overlap full width of mullions.
3. Room 113 - Office: At Type D Window, one blind unit mounted outside of window frame, overlap full width of mullions.
4. Room 114 - Fire Chief's Office: At each Type D Window, one blind unit mounted outside of window frame, overlap full width of mullions.
5. Room 115 - Office: At Type D Window, one blind unit mounted outside of window frame, overlap full width of mullions.
6. Room 118 - Watch: At Type A Window, one blind unit mounted outside of window frame, overlap full width of mullions.
7. Room 135 - Fitness:
   a. At Type B Window, three blind units mounted outside of window frame, overlap mullions 1/2 inch.
   b. At Type C Window, four blind units mounted outside of window frame, overlap mullions 1/2 inch.
8. Room 121 - Dining: At window adjacent to Door 121, one blind unit mounted outside of window frame overlap full width of mullions.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 12 2413
ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manual roller black-out shades and accessories indicated, specified, or required for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product indicated, specified, or required. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.

B. Samples for Initial Selection: Full range of standard manufacturer's colors available for shadecloths.

C. Maintenance Data: For inclusion in operation and maintenance manual required by Division 01.

1. Include manufacturer's instructions for maintenance of installed Work, including methods and frequency recommended for maintaining optimum condition under anticipated use.
2. Include precautions against cleaning products and methods which may be detrimental to finishes and performance.
3. Include name, address, and telephone number of manufacturer's nearest authorized service representative.

PART 2 - PRODUCTS

2.1 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.
   a. Electrical Characteristics: Single phase, 24 V, 60 Hz.
3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:
   a. Group Control Station: Momentary-contact, three-position, rocker-style, wall-switch-operated control station with open, close, and center off functions for single-switch group control.
   b. Color: As selected by Architect from manufacturer's full range.
4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.

B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of inside face of shade.
2. Direction of Shadeband Roll: Reverse, from front of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

E. Shadebands:

1. Shadeband Material: Light-blocking fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions:
1. Examine substrates to receive roller window shades and associated Work for compliance with requirements and other conditions affecting performance.
2. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents.
3. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION

A. Installation Quality Standards: In addition to standards listed elsewhere, perform work according to following, unless otherwise specified:
1. Respective manufacturer’s installation instructions.
2. Approved submittals.
3. Contract Documents.

B. Install level, plumb, and aligned with adjacent units.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 SCHEDULE

A. Locations:
1. Room 105 - Training:
    a. At each Type A Window, one shade unit mounted on room side of horizontal louver blinds, overlap full width of mullions.
    b. At each Type E Window, one shade unit mounted outside of window frame, overlap full width of mullions.

END OF SECTION

SECTION 22 0500
COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Work Included: **Provide complete plumbing systems where shown on the drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to the following summary of work:**

1. Furnish and install a complete sanitary waste and vent system as shown on the drawings, described herein and required to provide a complete code compliant system.

2. Furnish and install a complete domestic cold and hot water piping to all plumbing fixtures and equipment as shown on the drawings, described herein and required to provide a complete code compliant system.

3. Furnish and install a complete natural gas piping system to all equipment as shown on the drawings, described herein and required to provide a complete code compliant system.

4. Other items and services required to complete the systems.

B. Any Alternate Proposals are summarized in Division 01 of the Specifications. The Contractor is directed to refer to all Sections of the Specifications and Drawings for this project to determine the exact extent and scope of the various Alternate Proposals as each pertains to the work of all trades.

1.3 GENERAL REQUIREMENTS

A. Unless otherwise specified, materials are to be new and of current U.S. manufacture, free from defects and of the best quality of their respective kinds.

B. Equipment and/or materials damaged in shipment or handling, or otherwise damaged before installation, shall be replaced with new equipment and/or materials. Damaged equipment and/or materials shall not be repaired at the jobsite.

C. Furnishing of the proper equipment and/or materials and to see that it is installed as recommended by the manufacturer is entirely the responsibility of the Contractor. If required for proper installation, the Contractor shall obtain advice and supervisory assistance from a representative of the specific manufacturer of the equipment being installed.

D. Materials and adhesives to conform to Federal Standard Flame-Spread Properties, Inc., with composite fire and smoke hazard ratings, maximum 25 for flame spread and 50 for smoke developed. Adhesives to be waterproof.

E. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

F. Belts, pulleys, chains, gears, couplings, projecting screws, keys or other rotating parts which are located so that a person can come in close proximity thereto shall be fully enclosed properly provided with a guard.

1.4 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers that are thoroughly trained and experienced in the necessary crafts and are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation. **The contractor must support all pipe, equipment, and all other items furnished and installed under this scope from steel joists or structural steel frames. It is prohibited to support pipe, equipment, and all other items furnished under this scope from the metal deck.**

C. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

D. Codes: Perform all work in accordance with the adopted codes:
1. State and city building, fire, plumbing and mechanical codes.
2. International Fire Code
3. International Mechanical Code
4. International Plumbing Code
5. National Electrical Code
6. Energy Conservation Code
7. National Fire Protection Association (NFPA)
8. American with Disabilities Act (ADA)
9. ICC/ANSI A117.1 – 2003 Accessible and Useable Buildings and Facilities.
10. All authorities having jurisdiction.
11. Architectural code review drawing.

E. The Contractor shall comply in every respect with all requirements of National Fire Protection Association, local Fire Department regulations and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these Specifications and Drawings where specified conditions are of higher quality than the requirements of the above-specified authorities. Where requirements of the Specifications and Drawings are more lenient than the requirements of the above authorities having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities with no extra compensation.

F. Where conflicts occur between drawings, specifications or code requirements, the most stringent requirement shall take precedence.

G. Standards: The specifications and standards of the following organizations are by reference made a part of these specifications. All work, unless otherwise indicated, shall comply with the requirements and recommendations wherever applicable:
1. American National Standards Institute (ANSI).
2. Air Conditioning and Refrigeration Institute (ARI).
3. American Gas Association (AGA).
4. American Society for Testing and Materials (ASTM).
5. American Society of Mechanical Engineers (ASME).
6. American Society of Refrigeration, Heating and Air Conditioning Engineers (ASHRAE).
7. Electrical Testing Laboratories (ETL).
8. National Bureau of Standards (NBS).
9. National Electrical Manufacturer's Association (NEMA).
10. National Fire Protection Association (NFPA).
11. Sheet Metal and Air Conditioning National Association (SMACNA).
12. Underwriters Laboratories, Inc. (UL).

H. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. ASME Boiler and Pressure Vessel Code: Section IX.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements and recommendations of the latest edition of the Occupational Safety and Health Administration (OSHA) Act are by reference made a part of these specifications. All work shall comply with the requirements and recommendations wherever applicable.

1.6 SUBMITTALS

A. Comply with all submittal provisions of Division 1.

B. Engineer will not review electronically transmitted submittals. Submit hard copies of the submittal to the prime consultant (i.e. architect) in order to process and track the submittals properly in accordance with Division 1 and 22 submittal requirements.

C. Product Data: Submit the following:

1. Materials list of items proposed to be provided under Division 22.
2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.
3. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and/or pictures and diagrams to support and clarify. Organize in a clear and concise format. All substitutions shall be approved in writing by Architect. The Architect’s decision shall be final.
4. Allow a minimum of ten (10) working days for the review of submittals and each re-submittal.
5. Compliance with the Contract documents shall be the sole responsibility of the Contractor. Items on equipment that are were not accepted by the Architect in writing as an approved equal shall be replaced or revised to comply with the contract documents at the Contractor's expense.
6. Manufacturer's recommended installation procedures which, when reviewed by the Architect, shall become the basis for accepting or rejecting actual installation procedures used on the work.
7. Sign the submittal as an indication of compliance with the contract documents. Any deviations from the contract documents shall be indicated on the submittal prior to signing. Any deviations not indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

D. Submittals required of materials and equipment under this section include the following:

1. Piping and Accessories Materials:
   a. Clearly marked up manufacturer's data showing compliance with the specifications for:
      1. Piping material proposed for each system.
      2. Valves, cocks, and specialties.
      3. Flexible connectors for piping.
      4. Flanges.

   l/4" scale (minimum) sanitary sewer, storm water, domestic hot and cold water piping shop drawings showing coordinated piping routing and arrangements with all equipment, accessories and system expansion and contraction compensation methods. Shop drawing shall be submitted in 3D cad for coordination with trades in naviswork or similar format

2. Vibration Isolation and Sound Control Materials:
   a. Submit shop drawings showing the structural design and details of inertia bases, steel beam bases, and other custom-fabricated work not covered by manufacturer's submitted data.
   b. Furnish layouts of templates to be furnished to fabricators of equipment bases, foundations, and other support systems, as needed for coordination of vibration isolation units with other work.
   c. Submit shop drawings indicating the scope of vibration isolation work, locations of units and flexible connections. Include support isolation points for piping, motor driven equipment, inertia bases, etc.
   d. Include schedule of isolation units, showing size or manufacturer's part number, the weight supported and resulting deflection of each unit.
   e. For spring isolation units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.
   f. For spring-and-pad type isolation units, show the basis of spring rate selection for the range of loading weights.
3. Mechanical Identification Materials:
   a. Clearly marked-up product literature or samples showing compliance with specified materials for:
      1. Valve tagging.
      2. Pipe marking.
      3. Equipment marking.
4. Insulation:
   a. Manufacturer's certified data on thermal performance.
   b. Details, when required, of methods to be used in providing for unusual piping expansion and contraction.
   c. Manufacturer's data on any alternate insulation material of reduced thickness, including pre-insulated pipe.
   d. Manufacturer's data on all jacketing materials, sealants and fasteners.
   e.
5. Plumbing Materials:
   a. Clearly marked-up manufacturer's data showing compliance with the specifications on:
      1. Fixtures, carriers and all accessories.
      2. Plumbing equipment.
      3. Water hammer arresters.
      4. Backflow preventers.
      5. Trap primers
      6. Trapguards
      7. Tempering valves.
6. Heating:
   a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:
      1. Water Heaters
   b. Provide all electrical characteristics.
7. Record Documents: Reference the requirements detailed in this section.
8. Operation and Maintenance Data: Reference the requirements detailed in this section.

E. Resubmission of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus ten percent (10%).

1.7 SUBSTITUTIONS

A. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.

B. Submittals for "equal" items shall, where applicable, include the following data that are not necessarily required for specified items:
   1. Performance characteristics.
   2. Materials.
   3. Finish.
   4. Certification of conformance with specified codes and standards.
   5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in Paragraph 6 below.
   6. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/ Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and/or pictures and diagrams to support and clarify. Include shop drawings for all piping and ductwork equipment per Paragraph 1.5 Submittals. Organize in a clear and concise format.

C. Submittals of "equal" components or systems may be rejected if:
   1. The material or equipment would necessitate the alteration of any portion of the mechanical, electrical, architectural or structural design.
   2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, such substitutions will not be permitted. Proposals for substitutions shall be made only by the prime bidders. Manufacturers, distributors, and sub-contractors shall not make proposals to the Architect for substitutions.

E. All equipment installed on this project shall have local representation, local factory authorized service, and a local stock of repair parts

F. No substitution shall be made unless authorized in writing by the Architect. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, the Contractor shall replace this material or equipment with material or equipment specified, at his own expense, and to the satisfaction of the Architect.

G. Contractors submitting bids on substitute materials and equipment must also provide a written performance guarantee certifying that the substitute materials and equipment will produce the specified effects and meet the approval of the Architect.

1.8 ORDINANCES, PERMITS, METERS, UTILITIES AND ROYALTIES

A. Procure all permits and licenses necessary for completion of this project and pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. All required certificates of approvals and inspections by local governing and regulating authorities shall be obtained and paid for by the Contractor.

B. Pay all fees required for the connection of water, and sewer to utility mains, and any meter fees if required.

C. Pay any royalty payments required or fees for the use of patented equipment or systems. Defend all law suits or claims for infringement of any patent rights and shall hold the Owner and/or Architect/Engineer harmless from loss as a result of said suits or claims.

1.9 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of all component parts of the plumbing systems to assure compatibility of all equipment and performance of the integrated systems in accordance with the requirements of the specifications. Should the Contractor consider any part of the specifications or drawings as rendering his acceptance of such responsibility impossible, prohibitive, or restrictive, he shall notify the Engineer before submitting his bid, and the bid shall be accompanied by a written statement of any objections or exceptions to the specifications and drawings.

B. The size of plumbing equipment indicated on the Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Fabrication Drawings shall be prepared when required by the Architect/Engineer or Owner to indicate a suitable arrangement.

C. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

1.10 CONSTRUCTION REQUIREMENTS

A. The drawings show the arrangements of work. Should project conditions necessitate rearrangement, or if the materials or equipment can be installed to a better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit five copies of Drawings of the proposed arrangement for the Architect’s review. Allow a minimum of ten (10) working days for review.

B. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accompanied by shop drawings of the space in question. Identify monetary credits proposed or other benefits of the change. Allow a minimum of ten (10) working days for review.

C. The Contractor shall be responsible for the proper location and size of all slots, holes or openings in the building structure pertaining to his work and for the correct location of pipe sleeves.

1.11 CONNECTIONS FOR OTHERS

A. The Plumbing Contractor shall rough in for and make all water, sewer, etc. connections to all fixtures, equipment, machinery, etc., provided by others in accordance with detailed roughing-in Drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.

B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.

C. Provide all air gap fittings required, using materials hereinbefore specified. In each service line connected to an item of equipment or piece of machinery, provide a shutoff valve. On each drain not provided with a trap, provide a suitable trap.

D. All pipe fittings, valves, traps, etc., exposed in finished areas and connected to chrome plated lines provided by others shall be chrome plated to match.

E. Provide all galvanized sheet metal ductwork, transition pieces, etc., required for a complete installation. Exposed sheet metal shall be paint-grip type.

1.12 PROJECT RECORD DOCUMENTS

A. Provide the record documents associated with the work of Division 22 in strict accordance with the provisions of these specifications.

B. Throughout progress of the Division 22 Work, maintain an accurate record of changes in the Contract Documents that apply to work of Division 22. Changes shall include all addendums issued during bidding. Maintain an accurate record of the location of mechanical service lines and outlets and all outside utilities.

C. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect.

D. Accuracy of Records

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to show the change properly. Match the symbology and format of the base documents.
2. Accuracy of records shall be such that a future verification of items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

E. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

F. Making Entries on Drawings

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
2. Date all entries.
3. Call attention to the entry by a "cloud" drawn around the area or areas affected.
4. In the event of overlapping changes, use different colors for the overlapping changes.
5. Make entries within 24 hours after receipt of information that the change has occurred.
6. Maintain the base drawing format and use the same symbology.
7. Convert field mark-ups to finished CADD record drawings when required in this section.

G. Conversion of Schematic Layouts

1. In some cases on the drawings, arrangements of ductwork and piping and similar items are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement subject to the Architect's approval. However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the drawings.
2. Show on the job set of record drawings, by dimension accurate to within one inch, the centerline of each run of items such as all sleeves and piping, etc., below grade, in walls, or in the concrete slab. A surface mounted device indicates the exact location:
    a. Clearly identify the item by accurate note such as "Sanitary Sewer" and the like.

b. Show, by symbol or note, the vertical location of the item "under slab," "in ceiling plenum," "exposed," and the like.
c. Make all identification sufficiently descriptive that it may be related reliably to the specifications.

H. Final Project Record Documents
1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
2. Provide CAD electronic files in .dwg format using AutoCAD software. Upon written request, completion of a release form, and payment of the Engineer's standard fee of $200 plus applicable sales tax for a set-up charge and $50 per drawing plus applicable sales tax for copies of such files, Engineer will provide AutoCAD electronic files of base Contract Drawings in dwg format on compact discs. Engineer will also provide a list of drawing layers and names that shall be maintained.
3. Provide completed record drawings on CD-R and one full size hard copy of each drawing.
4. Refer to Division 1 for additional requirements.

1.13 OPERATION AND MAINTENANCE DATA

A. Submit two copies of a preliminary draft of the proposed manual or manuals to the Architect for review and comments. Allow a minimum of ten (10) working days for review.
B. Submit specified number copies of the approved manual to the Architect prior to indoctrination of operation and maintenance personnel.
C. Prepare in accordance with the following standards:

Format:	Size:	8½" x 11"
	Paper:	White bond, at least 20 lb. weight
	Text:	Neatly written or printed
	Drawings:	11" in height preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.
	Flysheets:	Separate each section of the Manual with neatly prepared flysheets briefly describing contents of the ensuing section; flysheets may be in color.
	Binding:	Use heavy-duty plastic or fiber-board covers with binding mechanism concealed inside the manual; 3-ring binders will be acceptable; all binding is subject to the Architect's approval.
	Measurements:	Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm. Where items may be expected to be measured within ten years in accordance with metric formulae, provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each manual, using durable material approved by the Architect, and clearly identified on or through the cover with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS

Name and Address of Work

Name of Contractor

General subject of this manual

Space for approval signature of the engineer and approval date

E. Contents: Include at least the following:
   1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.
   2. Complete instructions regarding operation and maintenance of all equipment provided including lubrication, disassembly, and reassembly.
   3. Complete nomenclature of all parts of all equipment.
   4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
   5. Copy of all guarantees and warranties issued.
   6. Manufacturer's bulletins, drawings, and descriptive data, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
   7. Such other data as required in other sections of these specifications.

1.14 WARRANTY

A. Contractor shall warranty all equipment and workmanship for a period of at least one year after date of substantial completion and replace or repair any faulty equipment or installation at no cost to the Owner for such service during this period, all in accordance with requirements of Division 1.

B. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.

C. Warranties shall be in writing in a form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

D. Upon completion of the work of Division 22, thoroughly clean all exposed portions of the mechanical installation, removing all traces of soil, labels, grease, oil and other foreign material and using only the type cleaner recommended by the manufacturer of the item being cleaned.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Access doors mounted in painted surfaces shall be of Milcor (Inland-Ryerson Construction Products Company) manufacturer, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be a minimum of 18" x 18" in size.

PART 3 - EXECUTION

3.1 ACCCESS DOORS

A. In fire-rated walls, access door shall be fire rated same as wall.

3.2 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect and governmental agencies having jurisdiction.

B. Make written notice to the Architect adequately in advance of each of the following stages of construction:
   1. When all rough-in is complete, but not covered.
   2. As specified in all Division 22 sections.
   3. At the completion of the work of Division 22.

C. When material or workmanship is found to not comply with the specified requirements, remove the noncomplying items from the job site and replace them with items complying with the specified requirements at no additional cost to the Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

3.3 INSTALLATION METHODS

A. Unless noted otherwise, piping may be run exposed in mechanical rooms and janitor's closets. Piping exposed in mechanical rooms and janitor's closets shall be run tight against the structure, as required by the Architect, allowing for expansion.

B. Conceal piping to be installed as hereinbefore specified.

C. Piping suspended from the structure shall be adequately and properly supported on hanger rods or clamps as specified in Section 22 0529 “Hangers and Supports for Plumbing Piping and Equipment”. Perforated strap hangers will not be permitted. **The contractor must support all pipe, equipment, and all other items furnished and installed under this scope from steel joists or structural steel frames. It is prohibited to support pipe, equipment, and all other items furnished under this scope from the metal deck.**

D. Where space is limited above ceilings, below concrete beams or other concrete projections, piping shall be sleeved through the beam or projection, rather than hung below. Provide sleeves where required and locate where approved by the Architect.

E. Cut pipe accurately to measurements established at the building and install into position without springing or forcing. All open ends of pipes shall be capped or otherwise closed until the systems are closed with final connections.

F. No pipe joints nearer than 12" to a wall, ceiling or floor penetration will be permitted, unless joint is of the welded type.

G. Piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Piping shall be graded for proper drainage.

H. Piping shall follow as closely as possible the routes shown on plans, which take into consideration conditions to be met at the site and in the building. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval from the Architect.

I. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping and in connections to equipment.

J. All piping shall be clean when it is installed; rust and/or dirt shall be removed.

K. Screw joints shall be made with taper threads, properly cut. Threads shall be cut using graphite and oil applied to the pipe only. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Pipe shall be up-ended and hammered to remove all shavings and foreign material, before installing.

L. Requirements for assembling joints in cast iron and copper lines are set forth elsewhere in these specifications. For any special materials, consult the manufacturers for the recommended procedures in assembling the joints.

M. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed items of the fire suppression system.

N. Install roof pipe penetrations through sleeves, and flash with membrane flashing and roofing mastic compatible with roofing system. Roofing Supplier/Contractor shall approve roof penetration and flashing.

O. Properly cap or plug all open ends of pipes and equipment to keep dirt and other foreign materials out of the system.

P. Arrangement:
1. All piping shall be run parallel to building lines and shall be arranged so as not to interfere with removal of other equipment or devices nor to block access to doors, windows, manholes or other access openings.
2. Piping shall be arranged so as to facilitate removal of tube bundles.
3. Piping shall be placed and installed so that there will be no interference with the installation of the equipment, ducts, etc.
4. All piping shall be installed to ensure noiseless circulation.
5. All valves and specialties shall be placed to permit easy operation and access.
6. All piping shall be erected and pitched to ensure proper draining.
7. Piping shall be installed so as to avoid liquid or air pockets throughout the piping system.
8. Eccentric reducers with flat side up shall be used wherever changes in pipe size would cause an air trap.
9. Expansion and contraction of piping shall be provided by expansion loops, bends or expansion joints to prevent injury to connections, piping, equipment or the building.

Q. Connections for Removal:
1. Install flanged connections, Victaulic couplings, or unions on all bypasses, ahead of all traps and at all connections to equipment, where shown on the drawings and where required to facilitate convenient removal of equipment. Piping connections to equipment shall include valves to allow isolating equipment for easy removal.

R. Sleeves
1. Provide sleeves around all pipes passing through walls, floors, ceiling, partitions, structural members or other building parts. Sleeves shall be per Section 22 0548, “Vibration and Seismic Controls for Plumbing Piping and Equipment”.

S. Plates
1. Provide spring clamp plates (escutcheons) where pipes are exposed in finished locations of the building and run through walls, floors or ceilings. Plates shall be chrome plated brass and shall be set tight on the pipe and to the building surface.

T. Flashing
1. Refer to Architectural Drawings and Specifications for flashing requirements.

U. For additional installation requirements, refer to individual sections in Division 22.

3.4 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work in strict accordance with the provisions of Division 1 of these Specifications and the following:
1. Coordinate work to minimize cutting and patching work. Cut and patch walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction. If cutting and patching is required, it shall be performed by trades specializing in that type work.

2. Perform Architect-approved cutting and demolition by methods which will prevent damage to other portions of the work and provide proper surfaces to receive installation of new work and/or repair.
    a. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect. Impact-type equipment will not be used except where specifically acceptable to the Architect.
    b. Openings in precast concrete slabs or walls for pipes, etc., shall be core drilled to exact size. Oversize the hole to allow for link seals, and to deter pipe corrosion condensation from forming.
    c. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.
    d. Openings cut through plaster or drywall shall be cut prior to plaster finish coat or texture coat on drywall. Cutting of the finish coat of plaster or texture coat of drywall will not be permitted unless written approval of the Architect is obtained.
    e. Openings shall be restored and/or repaired as required to replace the cut surface to an "as-new" and/or "as original" condition. Refer to the appropriate section of the specifications for the material involved.
3. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.
4. Provide all core drilling of holes. Where sleeves and/or blockouts are required, they shall be cut or provided at locations required. On completion of this work or as work progresses, make all repairs and do all patching required as a result of work under this Contract. All patching shall be performed in a manner that will restore the surrounding work to its original condition to the satisfaction of the Architect.
5. Assume responsibility for the proper size of all sleeves and/or blockouts in the building structure pertaining to the work and for providing the correct location of pipe sleeves and/or blockouts.
6. No cutting, boring or excavating which will weaken the structure will be permitted.

3.5 EXISTING UTILITIES AND TEMPORARY SERVICES FOR CONSTRUCTION

A. Verify the location and capacity of existing utility services pertaining to work of Division 22. Relocate existing utilities unearthed by excavation as directed by the utility service companies affected.
    1. Temporary Services for Construction
    2. Provide temporary services in strict accordance with the provisions of these specifications.

B. When any piece of plumbing equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly supervises the operation, and has the Architect's written permission to do so. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner, or date of substantial completion, whichever occurs first.

C. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

3.6 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the Drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

3.7 EXCAVATION AND BACKFILLING

A. Perform all excavation and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them in dry condition until the work has been installed. All shoring required to protect the excavation and safeguard employees shall be properly performed.

B. Perform excavation and backfilling in strict accordance with the provisions of these specifications including trench safety requirements.

C. All excavations shall be made to the proper depth, with allowances made for floor slabs, forms, beams, etc. Ground under piping shall be well compacted before piping is installed.

1. Cut the bottom of the trench or excavation to uniform grade so that pipe will bear on undisturbed soil.
2. Should rock be encountered, excavate 6" below pipe, fill with pea gravel and tamp well.
3. Carefully lay out alignment of pipe trenches to avoid obstructions. Secure approval of proposed route of pipe before any cutting is begun.

D. After pipe lines have been inspected, tested and approved, backfill trenches or excavation with material as recommended by the manufacturer of the type of pipe used.

E. Backfilling shall be made with selected soil, free from rocks and debris and shall be pneumatically tamped with 6 inch layers to secure a field density ratio of 95 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).

F. Excavated materials not suitable and not used in the backfill shall be removed from the site.

G. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, they shall be repaired at no cost to Owner.

H. Compact backfill where trenching or excavation is required in improved areas such as pavements, walks, lawns, and similar areas, to a condition equal to undisturbed earth, and restore surface of the area to the condition existing prior to the trenching or excavating operation.

I. In a lime stabilized area, the lime stabilization shall be fully restored after the excavation is complete.

J. Replace concrete, curbs, paving and other surface improvements cut during excavation to their original condition.

3.8 JOBSITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Include required work to correct conditions detrimental to the timely and proper completion of all Division 22 Work. Do not proceed until unsatisfactory conditions are corrected.

B. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering; the installation of electric heaters in electrical switchgear and similar equipment to prevent moisture damage. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

C. Take particular care not to damage the building structure in performing work. All finished floors, step treads, and finished surfaces shall be covered to prevent any damage by workmen or their tools and equipment during the construction of the building.

D. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these Specifications.

3.9 STORAGE AND PROTECTION

A. Contractor shall provide the required protection of equipment and materials from the time of delivery until the completion of the Work. Protect from damage, rust, rain, humidity and dust.

B. Do not receive equipment or materials on the jobsite until adequate space has been provided for storage.

C. Provide adequate supports for protection from the ground and erect required shelters for items stored in the open.

D. Items stored within the building are to be adequately protected and covered with tarpaulins or other protective covering.

E. Protect the building at all times during construction from damage by workmen, their tools and/or equipment. Protect floors, steps, wall, ceilings, doors, windows and other finish surfaces.

F. Equipment and materials found in a rusty condition at completion of the work will be thoroughly cleaned of rust and refinished as required to its original condition.

3.10 PREPARATION AND COORDINATION

A. Perform coordination work in strict accordance with provisions of these specifications and the following:

1. Coordinate as necessary with other trades to assure proper and adequate interface with all work.

2. Where pipes or other fire suppression items are shown in conflict with locations of structural members and other equipment, include labor and materials required for extensions, offsets and supports to clear the encroachment.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation of the fire suppression system.
4. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes is the responsibility of the Contractor making the change.

B. The Mechanical, Electrical, and associated Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. When the mechanical and electrical Drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

D. The general installation precedence of materials shall be as follows. Note that if an interference is encountered, this shall guide the contractor in the determination of which trade shall be given the "Right-of-Way".

Building lines
Structural Members
Soil and Drain Piping
Condensate Drains
Vent Piping
Supply, Return, and Outside Air Ductwork
Exhaust Ductwork
Fire Protection Piping
Gas Piping
Domestic Water (Cold and Hot)
Electrical Conduit

E. Where items such as diffusers, thermostats, switches, and control panels are not specifically located on the Drawings, locate as determined in the field by the Architect. Where such items are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.

F. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.

3.11 CLEANING AND FLUSHING

A. Remove all labels, dirt, paint, grease, and stains from all piping and accessories installed under this Contract. Flush and treat piping systems per Section 23 0953, “Testing, Adjusting and Balancing for HVAC”.

B. A temporary flushing connection shall be arranged for each section of piping. Water required for flushing shall be furnished by the Contractor. All temporary cross connections for flushing and drainage connections shall be furnished, installed and subsequently removed by the Contractor.

C. In filling the systems, be sure to vent in such a manner that the control valves cannot backfill, thus causing foreign matter to be introduced into the valve body.

3.12 PAINTING

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish. All work shall be subject to approval by Architect.

B. All equipment, piping, conduit, insulation, etc., furnished and installed in exposed areas under Divisions 22 of these Specifications and as hereinafter specified shall be cleaned, prepared, and painted according to the following specification. In the event of a conflict between the specifications referenced, the provisions of this specification shall prevail only for Division 22 work.

C. Before painting, materials and equipment surfaces shall be thoroughly cleaned of cement, plaster, and other foreign materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with the steel brushes to remove rust and other spots and left smooth and clean.

END OF SECTION

SECTION 22 0513
COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and poly-phase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in plumbing equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Provide a shaft grounding ring for motors used in direct-driven VFD motor applications.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3600 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.
   1. For motors with 2:1 speed ratio, consequent pole, single winding.

2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:
1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 MOTOR STARTERS

A. Provide motor starters as manufactured by one of the following:
1. General Electric Company.
2. Siemens Energy and Automation.
3. Square D Schneider Electric.
4. Cutler Hammer.

B. General:
   1. Starters furnished as integral parts of factory-assembled, pre-wired equipment shall conform to the requirements of this Section.
   2. All controllers shall be provided with a heavy-duty type push-button station, rated for 10 amperes continuous load at 600 volt or less.
   3. Enclosures shall be general purpose NEMA Type 1, except that pushbutton stations installed outside the building or otherwise exposed to the weather shall be NEMA Type 3R, dust and weather tight. NEMA Type 4 enclosures shall be provided for surface mounting, except as otherwise indicated.
   4. Pushbutton stations for non-interlocking contactors shall be momentary contact type with start button, stop button, and red indicator light. Where required for delayed "seal-in" or where otherwise noted.

C. Manual Motor Starters
   1. Provide single-phase, horsepower rated manual motor starters, of sizes and ratings indicated. Equip with manually operated quick-make, quick-break toggle mechanisms; and with one-piece melting alloy type thermal units. Starter to become inoperative when thermal unit is removed. Provide starters with double break, silver alloy contacts, visible from both sides of starter, green pilot lights, and switch capable of being padlocked “OFF”.
   2. Provide surface mounted starters in NEMA Type 1 or Type 3 enclosure as required.

D. Magnetic Motor Starters
   1. Provide fused disconnect switches complete with time delay fuses.
   2. Provide contactors with three overload relays.
   3. 120 volt holding coil.
   4. Provide pilot light in cover, green type.
   5. Provide reset button, and Hand-Off-Automatic switch behind lockable cover, field convertible to Off/Auto or Start/Stop pushbutton.
   6. Provide two sets of normally open auxiliary contacts in addition to standard auxiliary holding contacts supplied with each contactor.
   7. Provide surface mounted starters in NEMA Type 1 or Type 3 enclosure as required.

E. Combinations Motor Starters
   1. Provide fused, 3-pole, load break disconnect switches with RK-1 fuses, rotary operating handle, and lock-off facility.
   2. Restrict opening of switch enclosure by the use of a defeater screw, unless switch is in the OFF position.
   3. Provide contactors with three overload relays.
   4. 120 volt holding coil.
   5. Provide pilot light in cover, green.
   6. Provide reset button, and Hand-Off-Automatic switch behind lockable cover, field convertible to Off/Auto or Start/Stop pushbutton.
   7. Provide two sets of normally open auxiliary contacts in addition to standard auxiliary holding contacts supplied with each contactor.
   8. Provide control transformer of sufficient capacity to handle operating coil and associated controls.

PART 3 - EXECUTION

3.1 MOTOR STARTERS

A. Install motor starters as indicated, in accordance with Division 16 and equipment manufacturer's written instructions, and with recognized industry practices complying with applicable requirements of NEC, UL, and NEMA standards.
B. In finished areas, mount motor protection switches flush and install suitable cover plates.
C. Install heaters correlated with full load current of motors provided.

D. Set overload devices to suit motors provided.
E. Install fuses in fusible disconnect switches.
F. In fire-rated walls, access door shall be fire rated same as wall.
G. In detention areas provide minimum 16 gauge access door with keyed lock approved by Owner.

END OF SECTION

SECTION 22 0516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Flexible, ball-joint, packed expansion joints.
2. Slip-joint packed expansion joints.
3. Expansion-compensator packless expansion joints.
4. Flexible-hose packless expansion joints.
5. Metal-bellows packless expansion joints.
6. Rubber packless expansion joints.
7. Grooved-joint expansion joints.
8. Pipe loops and swing connections.
9. Alignment guides and anchors.

1.3 PERFORMANCE REQUIREMENTS

A. Compatibility: Products shall be suitable for piping service fluids, materials, working pressures, and temperatures.

B. Capability: Products to absorb 200 percent of maximum axial movement between anchors.

1.4 SUBMITTALS

A. Delegated-Design Submittal: For each anchor and alignment guide indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
1. Design Calculations: Calculate requirements for thermal expansion of piping systems and for selecting and designing expansion joints, loops, and swing connections.
2. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
3. Alignment Guide Details: Detail field assembly and attachment to building structure.
4. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

PART 2 - PRODUCTS

2.1 PACKED EXPANSION JOINTS

A. Flexible, Ball-Joint, Packed Expansion Joints:
1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
a. Hyspan Precision Products, Inc.

2. Standards: ASME Boiler and Pressure Vessel Code: Section II, "Materials"; and ASME B31.9, "Building Services Piping," for materials and design of pressure-containing parts and bolting.
3. Material: Carbon-steel assembly with asbestos-free composition packing.
4. Design: For 360-degree rotation and angular deflection.
5. Minimum Pressure Rating: 250 psig at 400 deg F.
6. Angular Deflection for NPS 6 and Smaller: 30 degree minimum.
7. Angular Deflection for NPS 8 and Larger: 15 degree minimum.
8. End Connections for NPS 2 and Smaller: Threaded.
9. End Connections for NPS 2-1/2 and Larger: Flanged.

B. Slip-Joint Packed Expansion Joints:
1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
   a. Hyspan Precision Products, Inc.
2. Standard: ASTM F 1007.
3. Material: Carbon steel with asbestos-free PTFE packing.
4. Design: With internal guide and injection device for repacking under pressure. Include drip connection if used for steam piping.
5. Configuration: Single joint with base and double joint with base class(es) unless otherwise indicated.
6. End Connections: Flanged or weld ends to match piping system.

2.2 PACKLESS EXPANSION JOINTS

A. Metal, Expansion-Compensator Packless Expansion Joints:
1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
   a. Metraflex, Inc.
2. Minimum Pressure Rating: 150 psig unless otherwise indicated.
3. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.
   a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Threaded.
4. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe end connections; and carbon-steel shroud.
   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 to NPS 4: Flanged.

B. Rubber, Expansion-Compensator Packless Expansion Joints:
1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
   a. Amber/Booth Company, Inc.; a div. of Vibration Isolation Products of Texas, Inc.
   b. Mason Industries, Inc.; Mercer Rubber Co.
2. Material: Twin reinforced-rubber spheres with external restraining cables.
3. Minimum Pressure Rating: 150 psig at 170 deg F unless otherwise indicated.
4. End Connections for NPS 2 and Smaller: Threaded.

C. Flexible-Hose Packless Expansion Joints:
1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
   a. Metraflex, Inc.
2. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
3. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.

4. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
   a. Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
   b. Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
5. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 300 psig at 70 deg F and 225 psig at 450 deg F ratings.
   b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 420 psig at 70 deg F and 315 psig at 450 deg F ratings.
6. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 450 psig at 70 deg F and 325 psig at 600 deg F ratings.
   b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 700 psig at 70 deg F and 515 psig at 600 deg F ratings.
7. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
   b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.
8. Expansion Joints for Steel Piping NPS 8 to NPS 12: Carbon-steel fittings with flanged end connections.
   a. Stainless-steel hoses and single-braid, stainless-steel sheaths with 125 psig at 70 deg F and 90 psig at 600 deg F ratings.
   b. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.
9. Expansion Joints for Steel Piping NPS 14 and Larger: Carbon-steel fittings with weld end connections.
   a. Stainless-steel hoses and double-braid, stainless-steel sheaths with 165 psig at 70 deg F and 120 psig at 600 deg F ratings.

D. Metal-Bellows Packless Expansion Joints:
1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
   a. Metraflex, Inc.
2. Standards: ASTM F 1120 and EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."
3. Type: Circular, corrugated bellows with external tie rods.
4. Minimum Pressure Rating: 150 psig unless otherwise indicated.
5. Configuration: Single joint with base and double joint with base class(es) unless otherwise indicated.
6. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
   a. End Connections for Copper Tubing NPS 2 and Smaller: Solder joint or threaded.
   b. End Connections for Copper Tubing NPS 2-1/2 to NPS 4: Solder joint or threaded.
   c. End Connections for Copper Tubing NPS 5 and Larger: Flanged.
7. Expansion Joints for Steel Piping: Single- or multi-ply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.
   a. End Connections for Steel Pipe NPS 2 and Smaller: Threaded.
   b. End Connections for Steel Pipe NPS 2-1/2 and Larger: Flanged.

E. Rubber Packless Expansion Joints:

1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
   a. Metraflex, Inc.
2. Standards: ASTM F 1123 and FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
3. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.
4. Arch Type: Single or multiple arches with external control rods.
5. Spherical Type: Single or multiple spheres with external control rods.
6. Minimum Pressure Rating for NPS 1-1/2 to NPS 4: 150 psig at 220 deg F.
7. Minimum Pressure Rating for NPS 5 and NPS 6: 140 psig at 200 deg F.
8. Minimum Pressure Rating for NPS 8 to NPS 12: 140 psig at 180 deg F.
9. Material for Fluids Containing Acids, Alkalies, or Chemicals: BR.
10. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N.
11. Material for Water: BR.
12. End Connections: Full-faced, integral steel flanges with steel retaining rings.

2.3 GROOVED-JOINT EXPANSION JOINTS

A. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
   a. Victaulic Company.

B. Description: Factory-assembled expansion joint made of several grooved-end pipe nipples, couplings, and grooved joints.

C. Standard: AWWA C606, for grooved joints.

D. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe with grooved ends.

E. Couplings: Five, flexible type for steel-pipe dimensions. Include ferrous housing sections, Buna-N gasket suitable for diluted acid, alkaline fluids, and cold and hot water, and bolts and nuts.

2.4 ALIGNMENT GUIDES AND ANCHORS

A. Alignment Guides:
   1. Basis-of-Design Product: Subject to compliance with requirements, based upon the following:
      a. Metraflex, Inc.
   2. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding spider for bolting to pipe.

B. Anchor Materials:
   1. Steel Shapes and Plates: ASTM A 36/A 36M.
   2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.
   3. Washers: ASTM F 844, steel, plain, flat washers.
   4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
      a. Stud: Threaded, zinc-coated carbon steel or stainless steel.
      b. Expansion Plug: Zinc-coated steel.
      c. Washer and Nut: Zinc-coated steel.
   5. Chemical Fasteners: Insert-type-stud, bonding-system anchor for use with hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Bonding Material: ASTM C 881/C 881M, Type IV, Grade 3, two-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
b. Stud: ASTM A 307, zinc-coated carbon steel or stainless steel with continuous thread on stud unless otherwise indicated.
c. Washer and Nut: Zinc-coated steel.

PART 3 - EXECUTION

3.1 EXPANSION-JOINT INSTALLATION

A. Install expansion joints of sizes matching sizes of piping in which they are installed.

B. Install packed-type expansion joints with packing suitable for fluid service.

C. Install metal-bellows expansion joints according to EJMA's "Standards of the Expansion Joint Manufacturers Association, Inc."

D. Install rubber packless expansion joints according to FSA-NMEJ-702.

E. Install grooved-joint expansion joints to grooved-end steel piping

3.2 PIPE LOOP AND SWING CONNECTION INSTALLATION

A. Install pipe loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.

3.3 ALIGNMENT-GUIDE AND ANCHOR INSTALLATION

A. Install alignment guides to guide expansion and to avoid end-loading and torsional stress.

B. Install two guide(s) on each side of pipe expansion fittings and loops. Install guides nearest to expansion joint not more than four pipe diameters from expansion joint.

C. Attach guides to pipe and secure guides to building structure.

D. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.

E. Anchor Attachments:
1. Anchor Attachment to Steel Pipe: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
2. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.

F. Fabricate and install steel anchors by welding steel shapes, plates, and bars. Comply with ASME B31.9 and AWS D1.1/D1.1M.
1. Anchor Attachment to Steel Structural Members: Attach by welding.
2. Anchor Attachment to Concrete Structural Members: Attach by fasteners. Follow fastener manufacturer's written instructions.

G. Use grout to form flat bearing surfaces for guides and anchors attached to concrete.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 22 0519
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.
6. Test plugs.
7. Test-plug kits.
8. Sight flow indicators.

1.3 QUALITY ASSURANCE

A. ASME B40.1: Gages, Pressure Indicating Dial Type, Elastic Element

B. ASTM E1: Specification for ASTM Thermometers

C. ASTM E77: Verification and Calibration of Liquid-in-Glass Thermometers

PART 2 - PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ashcroft Inc.
2. Trerice, H. O. Co.
3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
4. Weiss Instruments, Inc.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Non-reflective aluminum with permanently etched scale markings and scales in deg F.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Shatterproof glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Trerice, H. O. Co.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 6-inch nominal size.
4. Case Form: Back angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Shatterproof glass.
8. Stem: Aluminum or brass and of length to suit installation.
a. Design for Air-Duct Installation: With ventilated shroud.
b. Design for Thermowell Installation: Bare stem.
9. Connector: 3/4 inch, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Flo Fab Inc.
b. Trerice, H. O. Co.
c. Weiss Instruments, Inc.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Non-reflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
a. Design for Air-Duct Installation: With ventilated shroud.
b. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. General:
1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.

11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Dwyer Instruments, Inc.
   b. Trerice, H. O. Co.
   c. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   d. Weiss Instruments, Inc.
2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Siphons: Loop-shaped section of brass pipe with NPS 1/2 pipe threads.

C. Valves: Brass or stainless-steel needle, with NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trerice, H. O. Co.
2. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
3. Weiss Instruments, Inc.

B. Description: Test-station fitting made for insertion into piping tee fitting.

C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

D. Thread Size: NPS 1/2, ASME B1.20.1 pipe thread.

E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Flow Design, Inc.
   2. Trerice, H. O. Co.
   3. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
   4. Weiss Instruments, Inc.

B. Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.

C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.

D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch- diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.

E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.

F. Carrying Case: Metal or plastic, with formed instrument padding.

2.8 SIGHT FLOW INDICATORS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Archon Industries, Inc.
   2. Dwyer Instruments, Inc.
   3. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.

B. Description: Piping inline-installation device for visual verification of flow.

C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.

D. Minimum Pressure Rating: 125 psig.

E. Minimum Temperature Rating: 200 deg F.

F. End Connections for NPS 2 and Smaller: Threaded.

G. End Connections for NPS 2-1/2 and Larger: Flanged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

G. Install valve and snubber in piping for each pressure gage for fluids.

H. Install test plugs in piping tees.

I. Install flow indicators in piping systems in accessible positions for easy viewing.

J. Install permanent indicators on walls or brackets in accessible and readable positions.

K. Install connection fittings in accessible locations for attachment to portable indicators.

L. Install pressure gages in the following locations:
   1. As indicated in the Drawings.

3.2 CONNECTIONS

A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.3 ADJUSTING

A. After installation, calibrate meters according to manufacturer's written instructions.

B. Adjust faces of meters and gages to proper angle for best visibility.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 22 0523
GENERAL DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install items as shown on the drawings or as necessary to provide a complete working system in accordance with the intent of the drawings and specifications, including all valves as indicated or as necessary to completely control the entire piping system. The piping drawings are diagrammatic and indicate the general routing, locations, and connections. The piping may require be offsetting, lowering or rising as needed to avoid interferences or as directed at the site. This does not relieve the Contractor from responsibility for the proper installation of piping systems.

B. Work Included:

1. Work included:
   a. Sanitary drain, waste, and vent piping.
   b. Storm Drain and Subsoil drainage piping.
   c. Domestic hot and cold water piping.
   d. Equipment drains and relief valve piping.

C. Submittals: Provide submittals as required in Section 22 0500 “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements to comply with ANSI, ASTM, ASME, CISPI, IAPMO, PDI, and AWWA and all other applicable standards.

D. Copies of each welder's certification documents shall be furnished to the Architect prior to them performing work.

E. All pipes, valves, and fittings shall be manufactured in the United States. Mill Test reports and manufacturer’s certifications shall be submitted to the Engineer on all such materials used.

PART 2 - PRODUCTS

2.1 VALVES, COCKS AND SPECIALTIES

A. Materials: Bronze, ductile iron, or cast iron per local codes with screwed, Vic-Press 304™, grooved, or flanged ends for steel pipe and Permalynx push-to-connect, grooved, or solder ends for copper pipe.

B. Valve locations: Unless otherwise indicated, provide a valve on each branch serving a restroom.

1. Provide a valve on inlet and outlet of each piece of equipment.
2. Provide valves to isolate individual or group of fixtures and equipment on branch runouts from piping mains. This is in addition to valves at each fixture and equipment.
3. Provide interior shut-off and drain valves on each branch to wall hydrant and hose bibb.
4. Provide valves at the base of domestic water pipe risers.
5. Provide valves as indicated and where required to adequately service parts of systems and equipment.
6. Provide valves on hot and cold water lines in cell chases 6'-0" above finished floor at each level.

C. Gate Valves: Rated for 200 PSIG WOG:
1. 2-1/2" and below – Nibco T-113 for steel pipe and Nibco S-113, for copper pipe, or approved equal.
2. 3" and above – Victaulic Series 771 (cold water service), Nibco F-619 or engineer approved equal.

D. Ball Valves: Rated for 200 psig WOG.
1. 2-1/2" and below – Nibco T-595-Y for steel pipe and NVent PL-200 or Nibco S-595-Y for copper pipe or engineer approved equal.

E. Check Valves (Domestic Water System):
1. Swing check valve with bronze or composition disc rated for 200 psig WOG.
2. 2-1/2" and below – Nibco T-413-B, NVent PL-510, or engineer approved equal.
3. 3" and above – Nibco F-918-B, Victaulic Series 716, or engineer approved equal.

F. Water Balancing Cocks:
1. Provide cocks with memory stop, Dezurik 100 or approved equal.

G. Backflow Preventer:
1. Double check valve assembly consisting of two independently operating, spring loaded check valves, two gate valves, and four test cocks for field testing, Wilkins Model 950 or approved equal.
2. Provide reduced pressure type if required by local codes.

H. Water Hammer Arrestors:
1. Provide arrestors sized in accordance with PDI Standard WH-201, permanently sealed, pre-charged to 60 PSIG, suitable for temperatures up to 250 DegF and maximum 350 PSIG working pressure: Model 650 Series as manufactured by Sioux Chief Mfg. Co. or approved equal.
    a. Provide at each branch run-off to fixtures or as required by manufacturer and PDI Standard WH-201.
    b. For laundry applications, Series 660-H or approved equal.

I. Butterfly Valves:
1. Butterfly valves may be used in lieu of gate valves on chilled water and hot water heating lines rated to 150 psig: 2" - 12", with stem shall be offset from the disc centerline to provide full 360-degree circumferential seating, Victaulic Vic-300 MasterSeal™ or " Crane 21-BRZ (21-BRB under 150 Deg. F). 14" - 24" Victaulic Series W706 or Crane 22F-BRZ (22F-BRB under 150 Deg. F) or engineer approved equal as manufactured by Jenkins, Centerline or Victaulic.

J. Gas Solenoid Valves:
1. Gas Solenoid Valve shall be die-cast aluminum body with 2-way normally open operation with double disc design, with zero differential piloted diaphragm. Valve shall be UL listed to standard 429, and CSA certified to Standard C22.2 NO. 139 and Atuomatic Gas Valves Z21.21. ASCO Red Hat Series 8214 (200)

K. Gauge Cocks and Manual Air Vents:
1. Provide brass, lever handle cock, 1/4" FPT, as shown on the drawings or as specified herein.

L. Dielectric Union s or Waterway Fittings:
1. Provide dielectric unions or waterway fittings at all piping connections (except to valves) between dissimilar metals, Watts No. 3000 series, Victaulic Style 47, or engineer approved equal.

M. Trap Primers:
1. Trap primer valve shall be factory assembled, prepiped and shall include a bronze ¾" NPT, WOG rated inlet ball valve, a brass ¾" electronic solenoid valve and a type "L" copper manifold with brass compression fittings. Unit shall include a single point power connection at 120/1/60, a manual override switch, 2 amp breakers and geared 24 hour timer with relay and 5 second dwell function. A code approved atmospheric vacuum breaker shall be included for backflow protection. Complete unit shall be provided in a 16 gauge steel box with access door suitable for flush mounting or NEMA 1 rated box with cover for surface mounting. Trap primers shall be installed per manufacturer's instructions and recommendations.
   a. "Prime-Rite" PT or PTS as manufactured by Precision Plumbing Products, Inc. or approved equal.
   b. Trap primers shall be provided on all floor sinks and floor drains, except shower drains. Verify with authority having jurisdiction.

N. Trap Guards (If approved by local authority having jurisdiction):
1. Trap guard shall be manufactured from smooth, soft, flexible, elastomeric PVC material molded into shape of duck's bill, open on top with curl closure at bottom. The design shall allow for wastewater to open and adequately discharge floor drain through its interior and then close and returns to original molded shape after wastewater discharge is complete. Trap guard shall be as manufactured by ProSet Systems, Inc. or pre-approved equal.
2. Trap guard shall meet the following standards:
   a. ASME A112.6.3.
   b. NSF/ANSI 14.
   c. CSA B 79.
3. Prior to ordering trap guard, contractor shall confirm drain manufacturer provided for project to insure proper fit for trap guard. This shall be indicated on the submittal.

2.2 FLANGES

A. Flanges shall be 150 pound; A.S.A. forged steel, raised face, weld neck or slip-on. Slip-on flanges shall be welded both inside and outside.

B. Flange Adapters: Flat face, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741 or W45 flange adapter nipple for sizes 14" through 24".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install check valves for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level.
2. Lift Check Valves: With stem upright and plumb.

END OF SECTION

SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY
A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of all necessary identification items as indicated on the drawings and as specified.
B. Work included:
   1. Pipe hangers and supports.
   2. Concrete supports for equipment.
   3. Sleeving for plumbing equipment.
C. Submittals: Provide submittals as required in Section 22 0500 “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE
A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

1.4 REFERENCE STANDARDS
A. Automatic Sprinkler Pipe Supports: NFPA 13, Standard for the Installation of Sprinkler Systems.
B. Standpipe System Supports: NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS
A. Supports, hangers, anchors, guides and supplementary steel shall be provided for horizontal and vertical piping and shall meet or exceed the ASA Code for Pressure Piping.
B. Rod sizes noted are minimum sizes. The structural integrity of the supports is the responsibility of the Contractor.
C. Hangers Supporting and Contacting Brass or Copper:
   1. 3" and Smaller: Grinnell Fig. CT-109, copper plated, split-ring hanger with adjusters.
   2. 4" and Larger: Grinnell Fig. CT-65, copper plated, clevis hanger with 2 nuts each rod.
   3. Isolate copper or brass from ferrous metals with an approved dielectric material.
D. Hangers Supporting Insulated Lines:

1. Outside Diameter of Insulation 6" or Smaller and all Ferrous Pipe 3" Diameter and Smaller: Grinnell Fig. 108, malleable iron, split type with adjustable swivel and locknut.
2. Outside Diameter of Insulation 7" and Larger and all Ferrous Pipe Larger than 3" Diameter: Grinnell Fig. 260, malleable iron, clevis hanger with two nuts on each support.

E. Protection Shields for Hangers:
1. Galvanized metal shields shall encircle the lower half of the insulation.
2. Provide shields at hangers on domestic hot and cold water pipes on trapeze type hangers.
3. Provide rigid insulation at all shields and hangers, extending a minimum of 6" each side of hanger.
4. Shield gauges shall be as follows:

Insulation Diameter	U.S.S. Gauge (Galvanized)
Up to 3"	22
3" thru 6"	16
Above 6"	12

F. Supports for Vertical Riser Piping:
1. Provide Grinnell Fig. 261 double bolt riser clamps at each floor. Bear on structure.
2. At 8 feet o.c., 2-hole rigid clamps. Kindorf channels and C-105 straps. Support from vertical surfaces.
3. Brass or copper pipe shall be isolated from support with sheet polyethylene, minimum 1/8" thick.

G. Supports for Vertical and Horizontal Piping in Chases and Partitions:
1. Provide securely anchored supports for pipes serving plumbing fixtures and equipment near the area the pipe penetrates the wall.
2. Supports shall be steel plate, angles or unistruts mounted vertically or horizontally with unistrut clamps P2426, P2008 or P1109.
3. Attach supports to wall or floor construction with clip angles, brackets or other approved anchoring devices.
4. Brass and copper pipe shall be isolated from support with sheet polyethylene, minimum 1/8" thick.

2.2 INSERTS

A. Provide inserts at each hanger as required for concrete support. Avoid interference with concrete reinforcing.
B. Inserts to be malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, and lugs for attaching to forms.
C. Provide reinforcing as required to support load.
D. Size inserts to suit threaded hanger rods.

2.3 HANGER RODS

A. Provide steel hanger rods, threaded both ends, threaded one end or continuous threaded.

B. Size hanger rods as follows:

Pipe Size	Rod Diameter
4" & Smaller	3/8"
5" thru 8"	1/2"
10" & 12"	5/8"
14" & 16"	3/4"

2.4 SLEEVES

A. Provide sleeves where pipes penetrate floors, walls, foundations, fireproofing, etc.

B. Size sleeves large enough to allow for movement due to expansion and to provide for continuous movement. Provide a bead of sealant in space between pipe and sleeve. Use link-seal to seal between pipe and sleeve for all slab on grade floor penetrations.

C. Use Schedule 40 galvanized steel pipe sleeves for all floor and foundation penetrations. Sleeves shall extend minimum of 2" above finished floor and flush with vertical wall surface.

2.5 TRAPEZES

A. Trapezes of Kindorf, Elcen or approved equal may be provided where multiple lines run horizontally at the same elevation.

2.6 CONCRETE SUPPORTS FOR EQUIPMENT

A. Provide concrete pad foundations for the support of equipment such as floor-mounted pumps, etc.

B. Unless otherwise noted, concrete pads shall be constructed of not less than 3,000 lb. concrete and not less than 4" high and shall extend on all sides a minimum of 8 inches beyond the limits of the mounted equipment. Pads shall be poured in forms built of new-dressed lumber. All corners of the foundations shall be neatly chamfered 3/4" wide by means of sheet metal of triangular wood strips nailed to the form. Reinforce with No. 4 rebar 6" on center.

C. Foundation bolts, 3/4" round-hooked, shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of size to provide 1/2" clearance around bolt. Allow 1" below the equipment bases for alignment and grouting. After grouting, the forms shall be removed and the surface of the foundations shall be hand rubbed with carborundum.

D. Foundation pads for equipment located on the exterior of the building shall be provided as indicated.

E. Submit shop drawings of concrete pads for review by the Architect.

2.7 STRAP HANGERS

A. Under no circumstances will perforated strap iron or wire be acceptable for hangers on this project.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTS

A. All pipe supports shall be designed and installed to avoid interferences with other piping, hangers, ducts, electrical conduit, supports, building structure, equipment, etc. All piping shall be installed with due regard to expansion and contraction. The type of hanger, method of support, location of support, etc., shall be governed in part by this specification.

B. Pipe hangers shall be attached to the structure as follows:
   1. Poured-in-Place Concrete: Each hanger rod shall be fitted with a nut at its upper end, which nut shall be set into an Underwriters' Laboratories, Inc., listed universal concrete insert placed in the formwork before concrete is poured.
   2. Steel Bar Joists: Where pipes and loads are supported under bar joists, hanger rods shall be run through the space between the bottom angles and secured with a washer and two nuts. Where larger lines are supported beneath bar joists, hanger rods shall be secured to angle irons of adequate size. Each angle shall span across two or more joists as required to distribute the weight properly and shall be welded to the joists or otherwise permanently affixed thereto.
   3. Steel Beams: Pipes and loads supported under steel beams shall be installed using approved beam clamps.

3.2 SPACING

A. Cast iron soil pipe shall be supported on hangers spaced no more than pipe length being installed.

B. Install hangers for steel piping with the following maximum spacing and minimum rod sizes according to MSS SP 69 Tables 3 and 4:
   1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
   4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
   7. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
   8. NPS 3-1/2: Maximum span, 13 feet; minimum rod size, 1/2 inch.
   9. NPS 4: Maximum span, 14 feet; minimum rod size, 5/8 inch.
   10. NPS 5: Maximum span, 16 feet; minimum rod size, 5/8 inch.
   11. NPS 6: Maximum span, 17 feet; minimum rod size, 3/4 inch.
   12. NPS 8: Maximum span, 19 feet; minimum rod size, 3/4 inch.
   13. NPS 10: Maximum span, 22 feet; minimum rod size, 7/8 inch.
   14. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
   15. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
   16. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
   17. NPS 18: Maximum span, 28 feet; minimum rod size, 1 inch.
   18. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
   1 NPS 1/2: Maximum span, 5 feet; minimum rod size, 3/8 inch.
   2 NPS 5/8: Maximum span, 5 feet; minimum rod size, 3/8 inch.
   3 NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
   4 NPS 1-1/4: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   5 NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch
   6 NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
   7 NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
   8 NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
   9 NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Spacing and rod sizes for other piping materials shall be as recommended by the manufacturer.

3.3 TRAPEZES

A. Trapeze members, including suspension rods, shall be properly sized for the number, size and loaded weight of the lines they are to support. Install as noted above.

3.4 MISCELLANEOUS

A. Install any other special foundations, hangers and supports indicated on the drawings, specified elsewhere, or required by installation conditions.

3.5 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations associated with the work in accordance with the provisions of these specifications.

B. Provide concrete bases for all pad or floor mounted equipment.

3.6 HANGERS, SUPPORTS, ANCHORS AND GUIDES

A. All hangers and supports for fire standpipe systems and fire sprinkler systems shall be Underwriters' Laboratories, Inc. approved types.

B. Supports, hangers, anchors, and guides shall be provided for all horizontal and vertical piping as per the project specifications.

C. The Contractor shall be responsible for structural integrity of all supports. All structural hanging materials shall have a factor of safety of 5.

D. Anchor points and pipe guides as shown on drawings or as required shall be located and constructed to permit the piping system to take up its expansion and contraction freely in opposite directions away from the anchored points.

E. Guide points for expansion joints shall be located and constructed wherever required or shown on drawings and at each side of an expansion joint or loop, to permit only free axial movement in piping systems but shall not be further than 3 pipe diameters on each side of joint. Guides for pipe with expansion joints shall be of the roller type securely welded to structural steel.

F. Maximum spacing between pipe supports for steel, cast iron, plastic or copper pipe shall be per local code to prevent excessive stress: (This does not apply where there are concentrated loads between supports.)

G. Double bolt riser clamps shall be F & S, F & M, Grinnell or approved equal.

H. For copper tubing, supports shall be especially designed for copper tubing and shall be of exact O.D. diameter of tubing and shall be copper plated.

I. Roller type supports shall be used for pipes subject to axial movement. They shall be braced so that movement occurs in roller rather than support rods.

J. Provide miscellaneous steel required for support of pipes other than steel shown on the structural Drawings.

K. In general, all piping shall be supported from only structural building members or approved steel inserts embedded in concrete. Where structural members must be increased in strength and/or additional members added to provide for piping support, the mechanical contractor shall include such anticipated costs in his pricing.

3.7 SUPPORT OF VERTICAL RISERS

A. Vertical piping shall be installed in such manner that its weight plus the weight of its contents, covering and appurtenances cannot be concentrated at locations on slabs, beams and other structural elements to exceed the carrying capacity of those members as approved by the structural engineer.

B. In all cases, the Contractor shall coordinate the riser support design with the Architect. He shall submit drawings showing weights, points of support, and details of support or anchoring for approval. The Architect must approve the proposed method of support before work is started. The Contractor shall bear all responsibility for materials and workmanship described in this section and shall ensure that all hangers and supports are properly installed.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 22 0548
VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. The extent of vibration isolation work is indicated by drawings and schedules, and by the requirements of this section.

B. The types of vibration isolation work specified in this section include the following:
   1. Support isolation for motor-driven mechanical equipment.
   2. Isolation including support isolation for piping risers.
   3. Support isolation of piping.
   4. Flexible connections for piping at equipment.

C. Refer to other sections of these specifications for equipment foundations, hangers, sealants, gaskets, flexible connections for piping, and other work related to vibration isolation work.

1.3 QUALITY ASSURANCE

A. Product Qualification: Provide each type of vibration isolation unit produced by a specialized manufacturer, with not less than 5 years' successful experience in the production of units similar to those for the project.
   1. Except as otherwise indicated obtain support isolation units from a single manufacturer.
   2. Engage the manufacturer to provide technical supervision of the installation of support isolation units produced by him, and of associated inertia bases (if any).

B. Manufacturer: Acceptable vibration isolation support unit manufacturers are as follows:
   1. Mason Industries, Inc.
   2. Vibration Mountings and Controls, Inc.
   3. Amber Booth
   4. Peabody Kinetics

C. Manufacturer Certification: Where vibration isolation support units are indicated for a minimum static deflection, provide manufacturer's certification that units have been tested and comply with the indicated requirements.

D. All items of equipment, whether suspended, floor mounted or otherwise supported, which are capable of producing vibration, shall be installed with vibration isolation. The isolation shall prevent the transmission of objectionable noise or vibration to the building structure.

E. Submit for approval data showing disturbing frequency, supported weight, static deflection or natural frequency, and calculations supporting same for each isolator.

1.4 SUBMITTALS

A. Manufacturer's Data, Vibration Isolation:
   1. For information only, submit 2 copies of manufacturer's specifications, detailed drawings, performance characteristics data and installation instructions for each type of unit required.
   2. Include data for each type and size of unit, showing isolation efficiency, stiffness, natural frequency and transmissibility at lowest operating speed of equipment.
   3. Where required, include independent test agencies certified report of test results for each type of unit.

4. For spring units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.
5. For spring-and-pad-type units show basis of spring-rate selection for range of loading weights.
6. Include performance certifications where required.

PART 2 - PRODUCTS

2.1 ISOLATION MATERIALS AND SUPPORT UNITS

A. Double deflection neoprene mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom so they need not be bolted to the floor. Bolt holes shall be provided where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang.

B. Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short-circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

C. Vibration hangers shall be as described above, but they shall be precompressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be indicated by a scale.

D. Vibration hangers shall contain a steel spring located in a neoprene cup manufactured with a grommet to prevent short-circuiting. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hole sizes shall be large enough to permit the hanger rod to spring through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have as minimum additional travel to solid equal to 50% of the rated deflection. Hangers shall be provided with an eyebolt on the spring end and provision to attach the housing to the flat iron duct straps.

E. Vibration isolator shall be steel members welded to height saving brackets to cradle machines having legs or bases that do not require a complete supplementary base. Members shall be sufficiently rigid to prevent strains in the equipment.

F. Flexible neoprene connectors shall be used on all equipment as indicated on the drawings. They shall be manufactured of multiple plies of nylon tire cord fabric and neoprene. No steel wire or rings shall be used as pressure reinforcement. Straight connectors shall have two spheres. Neoprene elbows shall have a single sphere forming the corner of the joint itself. Connectors up to and including 2" diameter may have threaded ends. Connectors 2-1/2" and larger shall have floating steel flanges. All connectors shall be rated a minimum of 150 psi at 200 degrees F. All sizes operating at pressures above 100 psi shall employ control cables with end fittings isolated from the anchoring plates by means of 1/2" thick bridge bearing neoprene washer bushings designed for a maximum of 1000 psi.

G. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" and larger shall be flanged. Smaller sizes shall have male nipples. Lengths shall be as tabulated:

Flanges		Male Nipples	
3 x 14	10 x 26	1/2 x 9	1-1/2 x 13
4 x 15	12 x 28	3/4 x 10	2 x 14
5 x 19	14 x 30	1 x 11	2-1/2 x 18
6 x 20	16 x 32	1-1/4 x 12	
8 x 22			

H. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS.

I. Where piping passes through equipment walls, floors or ceilings, the vibration isolator shall be a split seal consisting of two bolted pipe halves with 3/4" or thicker neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" past either face of the wall. Where temperatures exceed 240 degrees F., 10# density fiberglass may be used in lieu of the sponge.

J. Isolator pads shall be neoprene waffle rated for 60#/sq. in.

K. Pipe Riser Isolators: Provide manufacturer's standard pad-type isolator bonded to steel plate, formed for welding to pipe sleeve extension.

PART 3 - EXECUTION

3.1 PERFORMANCE OF ISOLATORS

A. General: Comply with the minimum static deflections recommended by the manufacturer, including the definitions of critical and non-critical locations, for the selection and application of vibration isolation materials and units as indicated.

B. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

3.2 APPLICATIONS

A. General: Apply the types of vibration isolation materials and units indicated at the locations shown or scheduled. Selection is Contractor's option where more than one type is indicated.

B. Provide Neoprene Pads at the following locations/items of equipment:
   1. Where shown on drawings.

C. Provide Vibration Isolation Springs for the following items of equipment:
   1. Where shown on drawings.

D. Provide Spring Isolator, housed at the following items of equipment:
   1. Where shown on drawings.

E. Provide Isolation Hangers for the following:
   1. Piping connected to machinery.

3.3 INSTALLATION

A. General:
   1. Except as otherwise indicated, comply with manufacturer's instructions for the installation and load application to vibration isolation materials and units.

2. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points.
3. Remove spacer blocks and similar devices (if any) intended for temporary protection during shipping or against overloading during installation.
4. Anchor and attach units to substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.
5. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.
6. Install inertia base frames on isolator units as indicated, so that a minimum of 2" clearance below base will result when frame is filled with concrete and supported equipment has been installed and loaded for operation.
7. Locate isolation hangers as near the overhead support structure as possible.
8. Weld riser isolator units in place as required preventing displacement from loading and operations.

3.4 EXAMINATION OF RELATED WORK

A. Installer of vibration isolation work shall observe the installation of other work related to vibration isolation work, including work connected to vibration isolation work; and, after completion of other related work (but before equipment startup), shall furnish a written report to the Contractor listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover, but not necessarily be limited to the following:
   1. Equipment installations (performed as work of other sections) on vibration isolators.
   2. Piping connections including flexible connections.
   3. Passage of piping which is to be isolated through walls and floors.

B. Do not start-up equipment until inadequacies have been corrected in a manner acceptable to the vibration isolation Installer.

3.5 DEFLECTION MEASUREMENTS

A. Upon completion of vibration isolation work, take measurements and prepare a report showing measured equipment deflections for each item of equipment.

END OF SECTION

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of all necessary identification items as indicated on the drawings and as specified.

B. Work included:
   1. Valve tagging
   2. Pipe marking
   3. Equipment marking

C. Submittals: Provide submittals as required in Section 22 0500, “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified. Marking system shall conform to ASME 13.1, latest edition and OSHA 29 CFR 1910.261 requirements.

PART 2 - PRODUCTS

2.1 VALVE TAGS

A. Provide a tag for each valve in main and branch piping of domestic water piping systems.
   1. Tags shall be 1-1/2" diameter of solid brass with blacked filled stamped characters of 1/4" height above and 1/2" height below.
   2. Provide 8" long meter seals for use with valve tags.

B. Provide a valve chart with a schedule and location plans for all identified equipment, both in a frame with an acrylic cover to be located as directed by the Architect.

2.2 PIPE MARKERS

A. Provide pipe markers for pipes that provide 360 degree visibility with ANSI approved color coded background, color of legend in relation to background color, legend letter size, and length of color field. Additionally, direction of flow arrows shall be printed on the same markers, and words shall be repeated and reversed for use with flow in either direction.
   1. Each marker shall be formed with a clear acrylic covering suitable for use outdoors.

2. For diameters 3/4" to 6", marker shall be formed in order to snap on and completely surround the pipe. For diameters 6" and larger, provide radius formed markers of same material.

2.3 EQUIPMENT PLATES

A. Plate shall be black with white letters that appear when the plate is engraved.

B. Plate material shall be specifically suited for conditions surrounding the equipment. Outdoor equipment shall require special plate material for outdoor use.

C. Plate size shall be as required with lettering size appropriate for the information shown but in no case less than 1/8" high. Lettering style shall match existing facility standards.

D. Nomenclature for plates shall be based on the equipment designations shown on the equipment schedules and as approved by the Architect.

2.4 CONCEALED DEVICES

E. Operable devices and equipment located above ceilings shall be marked with color coded W. H. Brady "Tack" type markers.

2.5 MANUFACTURERS

A. Provide marking system as manufactured by W. H. Brady Company, Seton, Craftmark, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Place all markers and plates in such locations that they are easily read by a person without assuming awkward or hazardous positions.

3.2 VALVE TAGS

A. Secure one valve tag to each valve.

3.3 PIPE MARKERS

A. For diameters 3/4" to 6", markers shall snap around the pipe, completely surrounding the pipe. Markers shall not require taping or the use of any adhesive material or fasteners to permanently secure them to the pipe. For diameters 6" and larger, secure with stainless steel spring fasteners.

B. Install sufficient quantities of markers that tracing of pipe systems can be readily accomplished. Install within three feet before and/or after penetrations through walls, floors, ceilings, underground or other non-accessible enclosures; at access doors, manholes or other access points which permit view of concealed piping; and when there is a change in direction of the concealed pipe. Locations in major mechanical rooms shall be labeled at a maximum spacing of every 20 feet. Other piping shall have labels at a maximum spacing of every 30 feet and at least once in every area that the pipe passes over or through. Install additional markers where directed by the Architect.

3.4 EQUIPMENT PLATES

A. Provide engraved plates for all fire suppression equipment.

B. Secure all plates with two self-tapping metal screws with round heads. Alternately, plates may be fastened with "pop" rivets provided no cracking or injury occurs to the plate. Plates attached with adhesives shall not be permitted.

END OF SECTION

SECTION 22 0700
PLUMBING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the insulation of the plumbing systems as indicated on the drawings and as specified herein.

B. Factory insulated equipment is excluded from this section of the specifications except that the insulating material characteristics shall equal or exceed those of specified materials for similar service.

C. Work Included:

1. Piping:
   a. All above ground and below ground domestic hot and cold water piping.
   b. All horizontal sanitary drains handling cooling coil condensate.
   c. All plumbing items requiring insulation due to rules and regulations for the handicapped.

D. Submittals: Provide submittals as required in Section 22 0500, “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

D. Acceptable Manufacturers:

1. Fiberglass Insulation:
   a. Owens-Corning Fiberglas
   b. Manville
   c. Certain Teed
2. Urethane Insulation:
   a. Armstrong (Armalok)
   b. Thermacor
3. Mastics:
   a. Benjamin Foster
   b. Insul-Coustic
   c. Chicago Mastic
   d. Childers Products
4. High Temperature Bonding Cements: Ryder Thermocote
5. PVC Fittings: Zeston, Inc.

1.4 GENERAL

A. All materials shall be applied by workmen skilled in this trade. Mechanical fasteners shall be used whenever possible to assure permanent construction. Unsightly work shall be cause for rejection.

B. Materials will be applied only after all surfaces have been tested and cleaned.

C. All material, jacket, coverings, sealers, mastics and adhesives shall not exceed flame spread rating of 25 and smoke developed of 50 in accordance with ASTM Method E84, UL Standard 723 and NFPA Bulletins 255 and 90A.

D. Insulation shall be vermin resistant.

E. Non-compressible insulation material shall be installed at hangers of cold piping to eliminate through metal conductance.

F. Sizing, paint, and pipe shield or saddle shall be provided under other sections of Division 22.

G. Insulation of cold surfaces shall be vapor sealed.

H. Minimum thickness of insulation shall be as listed or energy code as adopted by authority having jurisdiction. However, sufficient insulation shall be provided to eliminate condensation on the cold surfaces and to maintain a maximum exterior insulation surface of 125ºF. (OSHA Standard) on the hot surfaces.

PART 2 - PRODUCTS

2.1 PIPE INSULATION

A. Pipe Insulation:

1. Above ground-Johns Manville AP-T preformed one-piece fiberglass with reinforced craft paper and aluminum foil jacket. Include vapor barrier where required.
   a. Use pre-formed PVC fitting covers with fiberglass inserts. Fiberglass shall be same density as pipe insulation.
   b. Where insulation is exposed to weather, use Manville Flame-Safe ML, or approved equal, Metal-Jacketed Fiberglass pipe insulation. Attachment shall be made by 1/2" 0.020 aluminum bands with approved closure system.
2. Armstrong Armaflex or equal may be used, in thermally equivalent thicknesses, but only for refrigerant suction lines where codes permit.
3. Condensate drain lines shall be insulated from AC unit to indirect waste termination points and first 10'-0" of horizontal drain line at floor drains receiving condensate. Material shall be closed cell type with 3/4" thick molded pipe covering with a density of 7 lbs. thermal conductivity at 0.28 at 75ºF. Do not split the insulation. All joints shall be glued with manufacturer's adhesive.

2.2 ADHESIVES

A. Water based, polymeric, UL classified lagging adhesive for applying canvas and glass cloth; Foster 30-36 or Childers CP-50.

B. A fast setting, rubber based, UL classified, vapor barrier lap and attachment adhesive; Foster 85-15 or Childers CP-85.

C. Same adhesive, except non-flammable when wet; Foster 85-20 or Childers CP-82.

D. A rubber based, UL classified, fast setting contact adhesive for adhering flexible cellular insulation; Foster 82-40 or Armstrong 520.

2.3 EXPANSION AND BALL JOINT INSULATION COVERS

A. Furnish and install removable and reusable insulation covers.

B. Insulation and jacketing material shall be as required for service temperatures.

C. Covers shall have hook and loop fasteners and draw cords.

2.4 INSULATION THICKNESS

A. Piping insulation thickness based on a maximum k value of 0.23 Btu in/hr ft² °F at a mean temperature of 75°F.

Pipe Sizes			
System	**Runouts To 12 ft. Max.**	**1 1/2 " and Less**	**1 1/2" Up**
Domestic hot water	1"	1"	2"
Domestic cold water.	1"	1"	1"
Horizontal drain bodies. EWC traps and tailpieces. Condensate drain piping.	1"	1"	1"

PART 3 - EXECUTION

3.1 GENERAL

A. The installation of all insulation shall be made by experienced craftsmen in a neat, workmanlike manner and shall be in accordance with the manufacturer's published recommendations for service intended, as interpreted by the Architect.

B. All adhesives used in conjunction with insulation shall be compatible with the insulation and vapor barrier used and be vermin-proof and mildew resistant.

3.2 APPLICATION

A. Install materials in accordance with manufacturer's instructions.

B. Insulation shall be the full specified thickness, continuous through walls, floors, ceilings, etc. Reducing thickness or cutting back of insulation to pass obstructions or through sleeves will not be permitted.

C. Valve and fitting insulation shall be built up to the thickness of the adjacent pipe insulation or may be factory prefabricated units at the Contractor's option.

D. Any painting of pipe insulation shall be accomplished under the Painting Section. After finish painting, any insulation showing splits or other signs of poor workmanship shall be replaced.

E. No part of any system shall be insulated until all required tests have been completed.

F. All insulation shall be installed so that it does not interfere with the functions of thermometer wells, gage connections and/or cocks, unions, access panels, hand holes, manholes, sight glasses, etc., or obscure serial numbers or other nameplate data.

G. Insulation shall be extended to include stiff leg supports as required to prevent sweating.

H. Complete vapor barriers to prevent sweating shall be installed on all cold systems and equipment. If a single tape adhesive system or staples are used for closure of the longitudinal lap, a vapor barrier mastic must be used to ensure a vaporproof closure. All edges and abutments shall be sealed, waterproof and vaporproof. Supplier of jacket materials shall certify that the material proposed is approved for use in return air plenums, where applicable.

I. Where necessary, the application of insulation shall be arranged to accommodate movement of piping due to thermal expansion and/or contraction.

J. Exterior Piping: All pipe and fittings specified herein to be insulated when installed exposed to weather, shall be insulated, and wrapped with an 0.016" smooth or corrugated aluminum jacket with proper closure system positioned to shed water to make a waterproof assembly. Fittings shall be insulated with molded insulation fittings or pipe insulation carved and mitered to fit properly. Insulation shall be butted together and adhered in place with contact cement. Where possible tubing shall be slipped on without slitting. Where insulation terminates, it shall be neatly beveled and finished. No portion of this insulation shall be concealed prior to approval by the Architect.

K. Below Grade Piping: All pipe and fittings specified herein to be insulated, when installed below grade shall be insulated and spirally wrapped with open mesh glass tape embedded in asphaltic mastic and then completely covered with waterproof asphaltic mastic so as to make a waterproof assembly. Fittings shall be insulated with molded insulation fittings or pipe insulation carved and mitered to fit properly. Insulation shall be butted together and adhered in place with contact cement. Where possible tubing shall be slipped on without slitting. Where insulation terminates, it shall be neatly beveled and finished. No portion of this insulation shall be concealed before the Architect has checked and approved same.

L. Piping supports shall pass completely around the exterior of the finished insulation. Rigid blocks of insulation material shall be provided at all support points. In addition, sheet metal saddles shall be provided at support points in accordance with the following table:

Pipe Size	Gauge Metal	Saddle Length
Up to 2-1/2"	18	6"
3" - 5"	16	10"
6" - 8"	16	14"
10" and Over	16	18"

M. Saddles shall cover the bottom of the insulation, and saddle edges shall be hemmed or suitably covered to prevent damage to the insulation material.

N. The vapor barrier and finish shall be continuous at all support points.

END OF SECTION

SECTION 22 1100
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install items as shown on the drawings or as necessary to provide a complete working system in accordance with the intent of the drawings and specifications, including all valves as indicated or as necessary to completely control the entire piping system. The piping drawings are diagrammatic and indicate the general routing, locations, and connections. The piping may require be offsetting, lowering or rising as needed to avoid interferences or as directed at the site. This does not relieve the Contractor from responsibility for the proper installation of piping systems.

B. Work Included:

1. Work included:
   a. Domestic hot and cold water piping.
   b. Valves.

C. Submittals: Provide submittals as required in Section 22 0500, “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements to comply with ANSI, ASTM, ASME, CISPI, IAPMO, PDI, and AWWA and all other applicable standards.

D. Copies of each welder's certification documents shall be furnished to the Architect prior to them performing work.

E. All pipes, valves, and fittings shall be manufactured in the United States. Mill Test reports and manufacturer’s certifications shall be submitted to the Engineer on all such materials used.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Domestic Hot and Cold Water Piping:

1. Piping below grade - 2" and smaller shall be Type K copper with wrought copper fittings; piping 2-1/2" and larger shall be cast iron AWWA class 150 water main with mechanical joint fittings.
2. Piping above grade may be Type L copper with wrought copper fittings. Where pipe sizes reduce, no sharp edged orifice type reducers shall be used in grooved pipe systems.
3. Provide lead-free solder joints for all fittings.
4. Provide lead-free solder joints for all fittings.

2.2 VALVES, COCKS AND SPECIALTIES

A. Materials: Bronze, ductile iron, or cast iron per local codes with screwed, Vic-Press 304™, grooved, or flanged ends for steel pipe and Permalynx push-to-connect, grooved, or solder ends for copper pipe.

B. Valve locations: Unless otherwise indicated, provide a valve on each branch serving a restroom.
   1. Provide a valve on inlet and outlet of each piece of equipment.
   2. Provide valves to isolate individual or group of fixtures and equipment on branch runouts from piping mains. This is in addition to valves at each fixture and equipment.
   3. Provide interior shut-off and drain valves on each branch to wall hydrant and hose bibb.
   4. Provide valves at the base of domestic water pipe risers.
   5. Provide valves as indicated and where required to adequately service parts of systems and equipment.

C. Gate Valves: Rated for 200 PSIG WOG:
   1. 2-1/2" and below – Nibco T-113 for steel pipe and Nibco S-113, for copper pipe, or approved equal.
   2. 3" and above – Victaulic Series 771 (cold water service), Nibco F-619 or engineer approved equal.

D. Ball Valves: Rated for 200 psig WOG.
   1. 2-1/2" and below – Nibco T-595-Y for steel pipe and NVent PL-200 or Nibco S-595-Y for copper pipe or engineer approved equal.

E. Check Valves (Domestic Water System):
   1. Swing check valve with bronze or composition disc rated for 200 psig WOG.
   2. 2-1/2" and below – Nibco T-413-B, NVent PL-510, or engineer approved equal.
   3. 3" and above – Nibco F-918-B, Victaulic Series 716, or engineer approved equal.

F. Water Balancing Cocks:
   1. Provide cocks with memory stop, Dezurik 100 or approved equal.

G. Backflow Preventer:
   1. Double check valve assembly consisting of two independently operating, spring loaded check valves, two gate valves, and four test cocks for field testing, Wilkins Model 950 or approved equal.
   2. Provide reduced pressure type if required by local codes.

H. Water Hammer Arrestors:
   1. Provide arrestors sized in accordance with PDI Standard WH-201, permanently sealed, pre-charged to 60 PSIG, suitable for temperatures up to 250 DegF and maximum 350 PSIG working pressure: Model 650 Series as manufactured by Sioux Chief Mfg. Co. or approved equal.
      a. Provide at each branch run-off to fixtures or as required by manufacturer and PDI Standard WH-201.
      b. For laundry applications, Series 660-H or approved equal.

I. Butterfly Valves:
   1. Butterfly valves may be used in lieu of gate valves on chilled water and hot water heating lines rated to 150 psig: 2" - 12", with stem shall be offset from the disc centerline to provide full 360-degree circumferential seating, Victaulic Vic-300 MasterSeal™ or " Crane 21-BRZ (21-BRB under 150 Deg. F). 14" - 24" Victaulic Series W706 or Crane 22F-BRZ (22F-BRB under 150 Deg. F) or engineer approved equal as manufactured by Jenkins, Centerline or Victaulic.

J. Gauge Cocks and Manual Air Vents:
   1. Provide brass, lever handle cock, 1/4" FPT, as shown on the drawings or as specified herein.

K. Dielectric Unions or Waterway Fittings:
   1. Provide dielectric unions or waterway fittings at all piping connections (except to valves) between dissimilar metals, Watts No. 3000 series, Victaulic Style 47, or engineer approved equal.

L. Trap Primers:
1. Trap primer valve shall be factory assembled, prepiped and shall include a bronze ¾" NPT, WOG rated inlet ball valve, a brass ¾" electronic solenoid valve and a type "L" copper manifold with brass compression fittings. Unit shall include a single point power connection at 120/1/60, a manual override switch, 2 amp breakers and geared 24 hour timer with relay and 5 second dwell function. A code approved atmospheric vacuum breaker shall be included for backflow protection. Complete unit shall be provided in a 16 gauge steel box with access door suitable for flush mounting or NEMA 1 rated box with cover for surface mounting. Trap primers shall be installed per manufacturer's instructions and recommendations.
   a. "Prime-Rite" PT or PTS as manufactured by Precision Plumbing Products, Inc. or approved equal.
   b. Trap primers shall be provided on all floor sinks and floor drains, except shower drains. Verify with authority having jurisdiction.

M. Trap Guards (If approved by local authority having jurisdiction):
1. Trap guard shall be manufactured from smooth, soft, flexible, elastomeric PVC material molded into shape of duck's bill, open on top with curl closure at bottom. The design shall allow for wastewater to open and adequately discharge floor drain through its interior and then close and returns to original molded shape after wastewater discharge is complete. Trap guard shall be as manufactured by ProSet Systems, Inc. or pre-approved equal.
2. Trap guard shall meet the following standards:
   a. ASME A112.6.3.
   b. NSF/ANSI 14.
   c. CSA B 79.
3. Prior to ordering trap guard, contractor shall confirm drain manufacturer provided for project to insure proper fit for trap guard. This shall be indicated on the submittal.

2.3 FLANGES

A. Flanges shall be 150 pound; A.S.A. forged steel, raised face, weld neck or slip-on. Slip-on flanges shall be welded both inside and outside.

B. Flange Adapters: Flat face, for direct connection to ANSI Class 125 or 150 flanged components. Victaulic Style 741 or W45 flange adapter nipple for sizes 14" through 24".

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall be performed by workmen skilled in the trade required for the work. All materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer and the best practices of the trade in conformance with the contract documents.

B. Refer to Section 22 0529, "Hangers and Supports for Plumbing Piping and Equipment" for general piping support requirements.

3.2 INSTALLATION

A. Refer to Section 22 0500, "Common Work Results for Plumbing" for general installation requirements.

B. Underground Pipe: The bottom of the trench shall be shaped to give substantially uniform support to the lower third of each pipe. Each pipe shall be laid true to line and grade and in such manner as to form a concentric joint with adjoining pipe and to prevent sudden offsets to flow line. As work progresses, the interior of the pipe shall be cleaned of dirt and foreign materials of any kind. Where cleaning after laying is difficult, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after joining has been completed. Trenches shall be kept free from water until pipe joining is complete and pipe shall not be laid when condition of trench or weather is unsuitable for such work. At all times when work is not in progress, all open ends of pipe fittings shall be securely closed to the satisfaction of the Architect so that no water, earth or other substance will enter pipe or fittings.

C. Erection of Pipe above Grade: Piping shall be properly supported and adequate provisions shall be made for flashing, expansion, contraction, slope and anchorage. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all structural elements, finished rooms, windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted.

D. All changes in direction shall be made with fittings, except that bending of pipe will be permitted providing a hydraulic pipe bender is used. Bent pipe showing kinks, wrinkles or other malformation will not be acceptable.

E. Copper tubing shall be joined by the following method:
   1. The tubing shall be reamed to remove all burrs from the inside diameter of the pipe.
   2. The tubing and fitting shall be sanded or brushed to a uniform bright finish.
   3. Apply a paste flux to both tubing and fitting.
   4. Fully heat the joined parts and apply solder to the joint.
   5. Completely fill the joint with solder, wiping any excess solder outside the joint while still liquid.
   6. NVent PermaLynx piping: Prepare copper tube and install in strict accordance with NVENT installation instructions. Pipe ends shall be cleaned, free from indentations, projections, burrs, and foreign matter. Use a tube preparation tool as supplied by NVent to clean and make installation mark. Push copper tube into fittings to installation depth mark, per NVent installation instructions. Keep fittings free of dirt and oil.

F. Mitering of pipe to form elbows or notching straight runs to form tees will not be permitted unless shop fabricated by a certified welder. Weldolet or Threadolet fittings may be used in lieu of welding tees.

G. Provide sleeves around all pipes passing through walls, floors, ceiling, partitions, structural members or other building parts.

END OF SECTION

SECTION 22 1123
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision and services necessary for or incidental to the installation of all pumps as indicated on the drawings and as specified.

B. Work Included

1. In-Line Circulators.

C. Submittals: Provide submittals as required in Section 22 0500, “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate and performance curves showing pumps meet or exceed the minimum requirements as specified.

PART 2 - PRODUCTS

2.1 IN-LINE CIRCULATORS

A. Shall be centrifugal in-line, all bronze construction, single stage, vertical split case design and shall be capable of being serviced internally without disturbing the piping. The working pressure shall be 175 psig. The impeller shall be of the enclosed type, dynamically and hydraulically balanced, keyed to the shaft and locked down. Provide with mechanical seal and oil lubricated sleeve bearings with readily accessible lubrication port. Pumps shall be coupled to the motor with a spring or resilient type coupling to ensure quiet operation. Provide pumps as manufactured by Grundfoss, Bell and Gossett, Taco, Thrush or Armstrong.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All pumps shall be located as shown or indicated on the drawings and installed as recommended by the manufacturer.

B. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitations, are non-overloading in parallel or individual operation, and operate within 15 percent of midpoint of published maximum efficiency curve.

C. Follow manufacturer's recommendations for testing and start-up.

END OF SECTION

SECTION 22 1300
FACILITY SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install items as shown on the drawings or as necessary to provide a complete working system in accordance with the intent of the drawings and specifications, including all valves as indicated or as necessary to completely control the entire piping system. The piping drawings are diagrammatic and indicate the general routing, locations, and connections. The piping may require be offsetting, lowering or rising as needed to avoid interferences or as directed at the site. This does not relieve the Contractor from responsibility for the proper installation of piping systems.

B. Work Included:

1. Work included:
    a. Sanitary drain, waste, and vent piping.
    b. Siphonic Storm Drain System
    c. Equipment drains and relief valve piping.

C. Submittals: Provide submittals as required in Section 22 0500, “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements to comply with ANSI, ASTM, ASME, CISPI, IAPMO, PDI, and AWWA and all other applicable standards.

D. Copies of each welder's certification documents shall be furnished to the Architect prior to them performing work.

E. All pipes, valves, and fittings shall be manufactured in the United States. Mill Test reports and manufacturer’s certifications shall be submitted to the Engineer on all such materials used.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Sanitary Drain, Waste, and Vent Piping:

1. Piping underground shall be service weight hub and spigot cast iron pipe and shall extend to above the floor. Joints shall be positive double seal elastomeric compression joints. Compression gaskets shall be in compliance with ASTM C 564.
2. Piping above grade, 1-1/2" or smaller and vent piping, may be threaded

galvanized schedule 40 steel or DWV copper. All 2" and larger pipe shall be service weight cast iron hub and spigot conforming to ASTM A 74 or "No Hub" conforming to CISPI 301.

3. Fittings shall be galvanized cast iron drainage fittings for threaded piping, cast iron soil fittings for hub and spigot piping conforming to ASTM A 74 and hubless couplings shall conform to CISPI Standard 310 and shall be listed with NSF International, DWV copper for DWV copper piping.
4. Pipe Manufacturers shall be Charlotte Pipe, Tyler Pipe, or AB&I.
5. Standard Coupling Manufacturers shall be Mission, Tyler, or Anico.

B. Siphonic Roof Drainage System:
1. Classified as an Alternative Engineered Design
2. System performance is related directly to pipe configuration, pipe material, pipe diameters, elevations, fittings and orientation ; notify system engineer of proposed changes prior to installation
3. System is based on Loro-Josam. Other manufacturers shall provide design prior to bidding for pre—approval.
   a. Connector Bends (Elbows):Loro-Josam Model# 05042.DD0X(3" equivalent). Made of hot-dip galvanized steel with additional internal epoxy coating to internal surfaces of pipe and reduce friction loss to flow
   b. Connectors (Pipes): Loro-Josam Model# 05043.DM0X(4" equivalent): Made of hot-dip galvanized steel with additional internal epoxy coating to protect internal surfaces of pipe and reduce friction loss to flow
   c. Adjusting Pieces (Reducers):Loro-Josam Model# 19602.ED0X(4" equivalent): Made of hot-dip galvanized steel with additional internal epoxy coating to protect internal surfaces of pipe and reduce friction loss to flow
   d. Siphonic Roof Drains: Loro-Josam Model # 21111.070X (3" equivalent)
      i. Capacity = 16.0 liters per second
      ii. Stainless Steel with Clamping Flange
      iii. With Thermal Insulation
   e. Siphonic Roof Drains: Loro-Josam Model # 21111.100X (4" equivalent) :
      i. Capacity = 16.0 liters per second
      ii. Stainless Steel with Clamping Flange
      iii. With Thermal Insulation

C. Equipment Drains and Relief Valve Piping:
1. All drain piping from air dryers, automatic air vents, pump bases, air handling units, etc., shall be Type L hard drawn copper, not less than connection size. Condensate drains shall be trapped. Extend all equipment drain piping to a suitable drain.
2. All relief valve piping shall be Type L hard drawn copper or schedule 40 steel, not less than valve outlet size. Extend discharge piping to a hub drain or floor receptor as required by local codes.

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall be performed by workmen skilled in the trade required for the work. All materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer and the best practices of the trade in conformance with the contract documents.

B. Refer to Section 22 0529, "Hangers and Supports for Plumbing Piping and Equipment" for general piping support requirements.

3.2 INSTALLATION

A. Refer to Section 22 0500, “Common Work Results for Plumbing” for general installation requirements.

B. Provide sleeves around all pipes passing through walls, floors, ceiling, partitions, structural members or other building parts.

C. Provide drainage lines with properly specified clean-outs. Locate clean-outs in runs at not more than 75' on center or as required by local codes. Provide clean-outs at base of each soil and waste stack and whenever necessary to make accessible all parts of drainage soil and waste systems whether or not indicated on drawings. Clean-outs located inside detention areas shall have security fasteners.

D. Extend clean-outs within chases to near wall and provide access cover compatible with wall construction.

E. Provide clean-outs of required size with flashing flange where installed with membrane water proofing. Lubricate threaded clean-out plugs. Provide clearance at clean-out for rodding of drainage system.

F. Lubricate threaded clean-out plugs. Provide clearance at clean-out for rodding of drainage system.

G. Encase exterior clean-outs in concrete flush with grade.

H. Securing the Siphonic Drain system : Loro-Josam piping system is considered to be a rigid installation. The piping system must be securely fastened at all necessary points.
   1. Install piping, hangers, and drains in accordance with manufacturers’ instructions
   2. All socket connections are to be installed with anchor clips. Anchor clips must be installed after Drains, after Branches, before Bends, and before Adjustment Pieces
   3. Anchor Clips must be installed at the transition point between downpipe and mains
   4. Anchor Clips must be installed on down pipes every 3 meter spacing
   5. Down pipe Supports must have a spacing of approximately 12 meters and at least once per down pipe section.

I. Installation of Siphonic Drain Instructions :
   1. Deviations from the planning specifications based on a hydraulic calculation are to be avoided. If modifications cannot be avoided, contact the planning engineer to have a re-calculation completed.
   2. Special attention must be paid to :
      a. Specified piping layout
      b. Length of individual pipe sections
      c. Heights of Collecting Pipes and individual Connecting Pipes
      d. Specified Pipe dimensions and layout of Roof Gullies
      e. Use the materials for the piping and the Roof Gullies as specified in the planning
      f. Pipes can be laid without gradient, but water must be able to drain off
      g. Pressure Drainage system must end at the backflow level(transfer into the open channel drainage)
      h. The mains in the ground must be connected with the siphonic system so that no backflow occurs
      i. Flanges of the Roof Gullies are to be sunk into the base and fixed there. Recesses in the ceiling are to be closed
      j. The Gullies and pipes are to be protected against soiling and contaminants during the time of construction. Pollutants are to be removed from the drainage pot before mounting the strainer unit
      k. Further instructions about the installation of Loro-Josam steel discharge pipes are contained in separate instructions which may be obtained from Josam Company

J. Minimum slope of piping shall be in accordance with the following unless otherwise specifically shown on the drawings or specified.

Type of Piping or Fluid Conveyed	System Component	Length for 1" Fall	Direction of Fall
Sewer, Sanitary through 3”	Main or Branch	4 feet	Direction of Flow
Sewer, Sanitary through 4” and above	Main or Branch	8 feet	Direction of Flow

END OF SECTION

SECTION 22 3436
COMMERCIAL GAS DOMESTIC WATER HEATER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of the heating system as indicated on the drawings and as specified. Provide factory trained start-up service for all equipment.

B. Work Included:

1. Electric Water Heater

C. Submittals: Provide submittals as required in Section 22 0500, “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

PART 2 – PRODUCTS

2.1 2.1 GAS FIRED TANK TYPE WATER HEATERS

A. Heater shall be gas fired, with burner type and output as scheduled. Unit efficiency shall be based on flue gas analysis and standby losses shall be per ASHRAE 90 standards or local energy codes, whichever is more stringent.

B. Heater shall be in compliance with the applicable provisions and recommendations of ASME Boiler and Pressure Vessel Code, and be UL listed.

C. Heater shall be furnished complete with but not limited to:

1. The outer jacket shall be of baked enamel finish and shall enclose the tank with insulation.
2. ASME temperature and pressure relief valve.
3. High temperature limit switch.
4. Operating controls, to include programmed pre-purge cycle spark ignition flame monitoring and normal burner control shall be by an adjustable operating thermostat.
5. Operating efficiency shall be a minimum of 98%.
6. Tank shall be warranted for 7 years – 4 full, 3 prorated.
7. Heat exchanger shall be warranted for 4 years full.
8. Vent material shall be 4” Schedule 40 CPVC.

D. Provide heaters as manufactured by PVI Industries, A.O. Smith, or Aerco.

2.2 HEATER FLUES

A. Flue shall be double wall with galvanized finish, UL listed Type B as manufactured by Metalbestos or approved equal with AGA approved vent cap, roof flashing and storm collar.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed in accordance with the manufacturer's recommendations.

B. Vent Piping:
   1. Install vent piping in accordance with manufacturer's instructions.
   2. Maintain same vent pipe diameter to end.
   3. Ensure vent pipe is gas tight and will not leak.
   4. Do not common vent or connect more than 1 appliance to venting system.
   5. Terminate horizontal or vertical vent in accordance with manufacturer's instructions.
   6. Slope horizontal vent 1/4 inch downwards for every 12 inches.
   7. Supply combustion air to units in accordance with ANSI Z223.1/NFPA 54.

C. Gas Piping:
   1. Install gas piping in accordance with manufacturer's instructions.
   2. Leak test gas appliances and its gas connections before placing in operation.
   3. Size gas piping in accordance with UPC or other accepted engineering method.

D. Electrical Wiring:
   1. Install electrical wiring in accordance with manufacturer's instructions.
   2. Do not connect electrical power to unit until electrical wiring has been completed.

E. Start up on the equipment shall be performed by factory trained and authorized personnel. A copy of the startup report shall be provided to the owner and submitted in the O&M Manuals.

3.2 EQUIPMENT START-UP

A. Prior to operation, the factory start-up representative shall, in the presence of the Architect's representative perform all system and equipment checks as prescribed by the manufacturer in his written start-up procedures.

B. The factory start-up representative shall place the equipment in operation and record all start-up data. Three copies of all data shall be given to the Architect.

END OF SECTION

SECTION 22 4200
COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision and services necessary for or incidental to the installation of a complete and operating plumbing system inside the building and to points outside the building as indicated on the drawings and as specified.

B. Work Included
   1. Plumbing fixtures.
   2. Plumbing accessories.
   3. Plumbing equipment.

C. Submittals: Provide submittals as required in Section 22 0500, “Common Work Results for Plumbing”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified. All work shall conform to the requirements of applicable codes.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Furnish and install all plumbing fixtures and equipment as scheduled and shown on drawings. All plumbing fixture brass trim shall be so designed that all wearing parts are to be in a standardized renewable operating unit which can be removed without detaching the supply fixture or faucet proper. The standardized renewable operating units are to be interchangeable with all supply fixtures and faucets. All exposed metal parts of all fixtures, including faucets, waste fittings, waste plugs, strainers, flush valves, traps, supplies, nipples and escutcheons shall be chromium plated brass, unless other materials or finish is specified. Angle stops with S.P.S. brass nipples from wall to stops shall be provided on all water supplies to fixtures. Fixture trim must be that of the fixture manufacturer wherever possible and must bear a permanent impression of the manufacturer.

B. Furnish and install all plumbing fixtures specified herein and shown on plans. Kohler and Just fixtures are specified, however, Crane, Elkay or American Standard may be used if they are equal in all respects to those specified. Contractor shall submit on trim as well as fixtures.

C. Wall hung fixtures where scheduled on drawings are to be supported by Josam, Wade, Smith or approved equal chair carriers with integral adjustable fittings.

D. Floor drains shall be as scheduled and in accordance with ANSI A112.21.1. Provide caulking flange for connection to cast iron pipe, screwed outlets for connection to steel pipe, and side outlet when shown. Provide suitable clamping device and extensions if required, where installed in connection with waterproofing membrane. (Submit detailed shop drawings for these drains). Double drainage pattern floor drains shall have integral seepage pan for embedding in floor construction, and weep holes to provide adequate drainage from pan to drain pipe. In detention areas drains shall have torx head screws with center dimple to secure top.

2.2 PLUMBING SPECIALTIES

A. Clean-outs

1. Provide drainage lines with properly specified clean-outs. Locate clean-outs in runs at not more than 75' on center or as required by local codes. Provide clean-outs at base of each soil and waste stack and whenever necessary to make accessible all parts of drainage soil and waste systems whether or not indicated on drawings. Extend clean-outs within chases to near wall and provide access cover compatible with wall construction. Provide clean-outs of required size with flashing flange where installed with membrane water proofing.
2. Exterior Surfaced Areas: Round cast nickel bronze access frame and vandal proof non-skid cover; Model 4245 as manufactured by JR Smith or approved equal.
3. Exterior Unsurfaced Areas: Ferrule type with coated cast iron body and round tapered thread bronze cover; Model 4280 as manufactured by JR Smith or approved equal.
4. Interior Finished Floor Areas: Coated cast iron body, round with scoriated cover Model 4025C in service areas, square with bronze foot traffic cover Model 4045C compatible with floor finish in finished floor areas or carpet clean-out cover where required; clean-outs shall be as manufactured by JR Smith or approved equal.
5. Interior Finished Wall Areas: Cast iron body, cast iron plug, and round flat stainless steel access cover secured with machine screw; Model 4402 as manufactured by JR Smith or approved equal.
6. Interior Unfinished Accessible Areas: Cast iron tee with threaded plug. Provide bolted stack clean-outs on vertical rainwater leaders.

B. Access Boxes (Coordinate all locations with Architect prior to installation): Provide 18 gauge steel frame and door with heavy duty piano hinge and keyed cam-lock.

1. Walls:
   a. Provide square frame and secured cover with brushed chrome plate finish in tile walls.
   b. Provide square frame and cover with bonderized prime-coated steel face and lock in walls of other finished rooms.
2. Ceilings:
   a. Provide square frame and cover with bonderized prime-coated steel face and lock.
3. Floors:
   a. Provide plain steel frame with plain nickel-bronze scoriated cover.

C. Provide cast brass "P" traps on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed traps shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be wrought cast brass. Slip joints not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture, or as scheduled.

PART 3 - EXECUTION

3.1 INSPECTION

A. Review millwork and other related shop drawings for coordination and ADA requirements. Confirm location and size of fixture and/or opening before rough-in and installation.

B. Verify adjacent construction is ready to receive rough in and finish work of this Section.

3.2 INSTALLATION OF PLUMBING PIPING

A. The plumbing piping system shall be installed as specified in Section 22 1300, “Facility Sanitary Sewerage”.

B. Lubricate threaded clean-out plugs. Provide clearance at clean-out for rodding of drainage system.

C. Encase exterior clean-outs in concrete flush with grade.

3.3 INSTALLATION OF PLUMBING FIXTURES

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons to make a watertight finished connection.

C. Fixture heights will be defined on the Architectural Drawings. Where the mounting heights vary, the defined heights as shown on the Architectural Drawings shall prevail. Install components level and plumb.

D. All fixtures must be securely fastened to the floor or walls by means of inserts or expansion bolts in concrete work, and by means of expansion bolts, toggle bolts or through bolts in masonry work, and by means of framing and screws in frame construction, to the satisfaction of the Architect.

E. Drains

1. Contractor shall install all floor and roof drains according to manufacturer's recommendations. Provide and install all flashing and weatherproofing as required. Adjust extension sections on all drains as required for proper height adjustment.
2. All floor drains to be trapped. Connect floor drains to sanitary waste piping as indicated on plans.
3. Each AC equipment drain opening which normally discharges water (such as air conditioning unit drains, overflows, and similar drips and drains) shall be connected to the drain openings by means of an indirect drain or piped down directly over the floor drains which are provided for this purpose.
4. Each water relief valve discharge shall be piped down to 6 inches above floor, but not necessarily over a floor drain or connected to a drain opening, unless otherwise indicated. No drain piping is required from the discharges or drain valves, unless otherwise indicated.
5. All drains, overflow, condensate and relief, to be routed to nearest trapped hub or floor drain if not shown on drawings.

3.4 ADJUSTING AND CLEANING

A. Adjust stops and regulating valves for intended water flow rate to fixtures without splashing, noise, or overflow.

B. At completion, clean plumbing fixtures and equipment.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 23 0500
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 DESCRIPTION

A. The General Requirements for Mechanical Work are intended to be complementary to the General Requirements of the Construction Contract.

B. Work Included: Provide complete mechanical systems where shown on the drawings, as specified herein, and as needed for a complete and proper installation including, but not necessarily limited to the following summary of work:

1. Furnish and install a complete gas system as shown on drawings and described herein.
2. Furnish and install a complete heating and air conditioning system as shown on drawings and described herein.
3. Furnish and install a complete ventilation system as shown on drawings and described herein.
4. Furnish and install a complete smoke removal system as shown on drawings and described herein.
5. Other items and services required to complete the systems.

1.3 GENERAL REQUIREMENTS

A. Unless otherwise specified, materials are to be new and of current U.S. manufacture, free from defects and of the best quality of their respective kinds.

B. Equipment and/or materials damaged in shipment or handling, or otherwise damaged before installation, shall be replaced with new equipment and/or materials. Damaged equipment and/or materials shall not be repaired at the jobsite.

C. Furnishing of the proper equipment and/or materials and to see that it is installed as recommended by the manufacturer is entirely the responsibility of the Contractor. If required for proper installation, the Contractor shall obtain advice and supervisory assistance from a representative of the specific manufacturer of the equipment being installed.

D. Materials and adhesives to conform to Federal Standard Flame-Spread Properties, Inc., with composite fire and smoke hazard ratings, maximum 25 for flame spread and 50 for smoke developed. Adhesives to be waterproof.

E. The Contractor shall promptly notify the Architect in writing of any conflict between the requirements of the Contract Documents and the manufacturer's directions and shall obtain the Architect instructions before proceeding with the work. Should the Contractor perform any such work that does not comply with the manufacturer's directions or such instructions from the Architect, he shall bear all costs arising in connection with the deficiencies.

F. Belts, pulleys, chains, gears, couplings, projecting screws, keys or other rotating parts which are located so that a person can come in close proximity thereto shall be fully enclosed properly provided with a guard.

1.4 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers that are thoroughly trained and experienced in the necessary crafts and are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation. **The contractor must support all duct, pipe, equipment, and all other items furnished and installed under this scope from steel joists or structural steel frames. It is prohibited to support duct, pipe, equipment, and all other items furnished under this scope from the metal deck.**

C. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

D. Codes: Perform all work in accordance with the adopted codes:
1. State and city building, fire, plumbing and mechanical codes.
2. International Fire Code
3. International Mechanical Code
4. International Plumbing Code
5. National Electrical Code
6. Energy Conservation Code
7. National Fire Protection Association (NFPA)
8. American with Disabilities Act (ADA)
9. ICC/ANSI A117.1 – 2003 Accessible and Useable Buildings and Facilities.
10. All authorities having jurisdiction.
11. Architectural code review drawing.

E. The Contractor shall comply in every respect with all requirements of National Fire Protection Association, local Fire Department regulations and utility company requirements. In no case does this relieve the Contractor of the responsibility of complying with these Specifications and Drawings where specified conditions are of higher quality than the requirements of the above-specified authorities. Where requirements of the Specifications and Drawings are more lenient than the requirements of the above authorities having jurisdiction, the Contractor shall make installations in compliance with the requirements of the above authorities with no extra compensation.

F. Where conflicts occur between drawings, specifications or code requirements, the most stringent requirement shall take precedence.

G. Standards: The specifications and standards of the following organizations are by reference made a part of these specifications. All work, unless otherwise indicated, shall comply with the requirements and recommendations wherever applicable:
1. American National Standards Institute (ANSI).
2. Air Conditioning and Refrigeration Institute (ARI).
3. American Gas Association (AGA).
4. American Society for Testing and Materials (ASTM).
5. American Society of Mechanical Engineers (ASME).
6. American Society of Refrigeration, Heating and Air Conditioning Engineers (ASHRAE).
7. Electrical Testing Laboratories (ETL).
8. National Bureau of Standards (NBS).
9. National Electrical Manufacturer's Association (NEMA).
10. National Fire Protection Association (NFPA).
11. Sheet Metal and Air Conditioning National Association (SMACNA).
12. Underwriters Laboratories, Inc. (UL).

H. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
   2. ASME Boiler and Pressure Vessel Code: Section IX.

1.5 REQUIREMENTS OF REGULATORY AGENCIES

A. The requirements and recommendations of the latest edition of the Occupational Safety and Health Administration (OSHA) Act are by reference made a part of these specifications. All work shall comply with the requirements and recommendations wherever applicable.

1.6 SUBMITTALS

A. Comply with all submittal provisions of Division 1.

B. Engineer will not review electronically transmitted submittals. Submit hard copies of the submittal to the prime consultant (i.e. architect) in order to process and track the submittals properly in accordance with Division 1, and 23 submittal requirements.

C. Product Data: Submit the following:
   1. Materials list of items proposed to be provided under Division 23.
   2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract document requirements. Items that do not clearly meet this definition should be identified and explained as required in the following paragraph.
   3. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and/or pictures and diagrams to support and clarify. Organize in a clear and concise format. All substitutions shall be approved in writing by Architect. The Architect’s decision shall be final.
   4. Allow a minimum of ten (10) working days for the review of submittals and each re-submittal.
   5. Compliance with the Contract documents shall be the sole responsibility of the Contractor. Items on equipment that are were not accepted by the Architect in writing as an approved equal shall be replaced or revised to comply with the contract documents at the Contractor's expense.
   6. Manufacturer's recommended installation procedures which, when reviewed by the Architect, shall become the basis for accepting or rejecting actual installation procedures used on the work.
   7. Sign the submittal as an indication of compliance with the contract documents. Any deviations from the contract documents shall be indicated on the submittal prior to signing. Any deviations not indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

D. Submittals required of materials and equipment under this section include the following:
   1. Piping and Accessories Materials:
      a. Clearly marked up manufacturer's data showing compliance with the specifications for:
         1) Piping material proposed for each system.
         2) Valves, cocks, and specialties.
         3) Flexible connectors for piping.
         4) Flanges.
      b. l/8" scale (minimum) gas, and refrigerant piping shop drawings showing coordinated piping routing and arrangements with all equipment, accessories and system expansion and contraction compensation methods.

2. Vibration Isolation and Sound Control Materials:
   a. Submit shop drawings showing the structural design and details of inertia bases, steel beam bases, and other custom-fabricated work not covered by manufacturer's submitted data.
   b. Furnish layouts of templates to be furnished to fabricators of equipment bases, foundations, and other support systems, as needed for coordination of vibration isolation units with other work.
   c. Submit shop drawings indicating the scope of vibration isolation work, locations of units and flexible connections. Include support isolation points for piping, air handling units, inertia bases, etc.
   d. Include schedule of isolation units, showing size or manufacturer's part number, the weight supported and resulting deflection of each unit.
   e. For spring isolation units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.
   f. For spring-and-pad type isolation units, show the basis of spring rate selection for the range of loading weights.
3. Mechanical Identification Materials:
   a. Clearly marked-up product literature or samples showing compliance with specified materials for:
      1) Valve tagging.
      2) Pipe marking.
      3) Equipment marking.
4. Insulation:
   a. Manufacturer's certified data on thermal performance.
   b. Details, when required, of methods to be used in providing for unusual piping expansion and contraction.
   c. Manufacturer's data on any alternate insulation material of reduced thickness, including pre-insulated pipe.
   d. Manufacturer's data on all jacketing materials, sealants and fasteners.
5. Heating:
   a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:
      1) Flue pipe and accessories.
      2) Unit heaters.
   b. Provide all electrical characteristics.
6. Refrigeration:
   a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:
      1) Condensing Units
   b. Provide all electrical characteristics.
7. Air Handling:
   a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:
      1) AHU, factory assembled.
      2) Fan coil units.
      3) Filters.
   b. Provide all electrical characteristics.
8. Ventilation Fans and equipment:
   a. Shop Drawings: Indicate assembly of centrifugal fans and accessories including fan curves with specified operating point clearly plotted, sound power levels for both fan inlet and outlet at rated capacity, and electrical characteristics and connection requirements.
   b. Product Data: Submittal data for approval for all fans of every description

furnished. Fans driven by 5 (five) HP and larger motors shall include the following:

1) Fan curves with specified operating point clearly plotted. The recommended range of operation shall be stable.
2) Fans shall be capable of operating stably at reduced loads imposed by means of variable speed drives.
3) Data on sound power levels for both fan inlet and outlet at rated capacity.
4) Electrical characteristics and connection requirements.
5) All data on fan accessories.
6) Manufacturer's Installation Instructions.

9. Air Distribution Materials:
   a. Provide clearly marked-up manufacturer's data showing compliance with scheduled values and specifications for:
      1) Air devices.
      2) 1/4" scale ductwork shop drawings for all systems showing equipment locations, detailed data such as bottom of duct elevations, airstream sizes, all duct accessories, and duct construction details showing compliance with SMACNA requirements for the specified duct pressure of each system. Shop drawing shall be submitted in 3D cad for coordination with trades in naviswork or similar format
      3) Fire dampers, fire and smoke dampers.
10. Testing and Balancing:
   a. Brief description of test and balance contractor experience.
   b. Certificate of Qualification from AABC.
   c. Biographical information of the Registered Professional Engineer and certified Test and Balance Supervisor proposed to manage the project.
   d. List of instruments to be used with latest date of calibration test for each.
   e. Test and balance reports.
11. Record Documents: Reference the requirements detailed in this section.
12. Operation and Maintenance Data: Reference the requirements detailed in this section.

E. Resubmission of rejected submittals shall be limited to one (1) in number. Costs for processing subsequent resubmittals in excess of the first resubmittal, resulting from the Contractor's disregard of Architect/Engineer's primary submittal rejection comments, shall be borne by the Contractor. Costs shall be based on Architect/Engineer's hourly rates as published in their current professional fee schedules and shall also include reimbursable costs for delivery, mailing, and photocopies at direct cost plus ten percent (10%).

1.7 SUBSTITUTIONS

A. Comply with all provisions of Division 1.

B. The use of manufacturers' names and catalog numbers followed by the phrase "or equal" is generally used to establish a standard of quality and utility for the specified items and to provide a dimensional reference for construction documents that are drawn to scale.

C. Submittals for "equal" items shall, where applicable, include the following data that are not necessarily required for specified items:
   1. Performance characteristics.
   2. Materials.
   3. Finish.
   4. Certification of conformance with specified codes and standards.
   5. Manufacturer's specifications and other data needed to prove compliance with the specified requirements. The term "Compliance" is understood to mean that the Contractor certifies that the submitted equipment will meet or exceed the contract

document requirements. Items that do not clearly meet this definition should be identified and explained as required in Paragraph 6 below.

6. Identify the difference between the specified item or function and the proposed. Explain with enough detail so that the Architect/ Engineer/Owner can easily determine that the item complies with the functional intent. List any disadvantages or advantages of the proposed item versus the specified item. Submit technical data sheets and/or pictures and diagrams to support and clarify. Include shop drawings for all piping and ductwork equipment per Paragraph 1.5 Submittals. Organize in a clear and concise format.

D. Submittals of "equal" components or systems may be rejected if:
   1. The material or equipment would necessitate the alteration of any portion of the mechanical, electrical, architectural or structural design.
   2. Dimensions vary from the specified material or equipment in such a manner that accessibility or clearances are impaired or the work of other trades is adversely affected.

E. Proposed substitutions for materials or equipment must be submitted ten (10) days prior to final bid date for consideration as approved equals. Otherwise, such substitutions will not be permitted. Proposals for substitutions shall be made only by the prime bidders. Manufacturers, distributors, and sub-contractors shall not make proposals to the Architect for substitutions.

F. All equipment installed on this project shall have local representation, local factory authorized service, and a local stock of repair parts

G. No substitution shall be made unless authorized in writing by the Architect. Should a substitution be accepted, and should the substitute material prove defective or otherwise unsatisfactory for the service intended, and within the guarantee period, the Contractor shall replace this material or equipment with material or equipment specified, at his own expense, and to the satisfaction of the Architect.

H. Contractors submitting bids on substitute materials and equipment must also provide a written performance guarantee certifying that the substitute materials and equipment will produce the specified effects and meet the approval of the Architect.

1.8 ORDINANCES, PERMITS, METERS, UTILITIES AND ROYALTIES

A. Procure all permits and licenses necessary for completion of this project and pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. All required certificates of approvals and inspections by local governing and regulating authorities shall be obtained and paid for by the Contractor.

B. Pay all fees required for the connection of gas to utility mains, and any meter fees if required.

C. Pay any royalty payments required or fees for the use of patented equipment or systems. Defend all law suits or claims for infringement of any patent rights and shall hold the Owner and/or Architect/Engineer harmless from loss as a result of said suits or claims.

1.9 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of all component parts of the mechanical systems to assure compatibility of all equipment and performance of the integrated systems in accordance with the requirements of the specifications. Should the Contractor consider any part of the specifications or drawings as rendering his acceptance of such responsibility impossible, prohibitive, or restrictive, he shall notify the Engineer before submitting his bid, and the bid shall be accompanied by a written statement of any objections or exceptions to the specifications and drawings.

B. The size of mechanical and electrical equipment indicated on the Drawings is based on the dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if the equipment he proposes to furnish will fit in the space. Fabrication Drawings shall be prepared when

required by the Architect/Engineer or Owner to indicate a suitable arrangement.

C. All equipment shall be installed in a manner to permit access to all surfaces. All valves, motors, drives, filters, and other accessory items shall be installed in a position to allow removal for service without disassembly of another part.

1.10 CONSTRUCTION REQUIREMENTS

A. The drawings show the arrangements of work. Should project conditions necessitate rearrangement, or if the materials or equipment can be installed to a better advantage in a different manner, the Contractor shall, before proceeding with the work, prepare and submit five copies of Drawings of the proposed arrangement for the Architect's review. Allow a minimum of ten (10) working days for review.

B. Should the Contractor propose to install equipment requiring space conditions other than those shown, or rearrange the equipment, he shall assume responsibility for the rearrangement of the space and shall have the Architect review the change before proceeding with the work. The request for such changes shall be accompanied by shop drawings of the space in question. Identify monetary credits proposed or other benefits of the change. Allow a minimum of ten (10) working days for review.

C. The Contractor shall be responsible for the proper location and size of all slots, holes or openings in the building structure pertaining to his work and for the correct location of pipe sleeves.

1.11 CONNECTIONS FOR OTHERS

A. The Mechanical Contractor shall rough in for and make all gas connections to all equipment, machinery, etc., provided by others in accordance with detailed roughing-in Drawings provided by the equipment suppliers, by actual measurements of the equipment connections, or as detailed.

B. After the equipment is set in place, this Contractor shall make all final connections and shall provide all required pipe, fittings, valves, traps, etc.

C. Provide all air gap fittings required, using materials hereinbefore specified. In each service line connected to an item of equipment or piece of machinery, provide a shutoff valve. On each drain not provided with a trap, provide a suitable trap.

D. All pipe fittings, valves, traps, etc., exposed in finished areas and connected to chrome plated lines provided by others shall be chrome plated to match.

E. Provide all galvanized sheet metal ductwork, transition pieces, etc., required for a complete installation. Exposed sheet metal shall be paint-grip type.

1.12 LOCATION OF OUTLETS

A. Supply and return air outlets in suspended acoustical tile ceilings shall occur symmetrically in tile joints or in the centers of whole tiles. The final determination of the exact location of each outlet and the arrangement to be followed shall be acceptable to the Architect.

B. The drawings show the locations of the various outlets and equipment. Exact locations of these outlets and equipment shall be determined by reference to the general construction plans and to all detail drawings, equipment drawings, roughing-in drawings, etc., by measurements at the building, and in cooperation with the other trades. The Architect reserves the right to make any reasonable change in location of any outlet or equipment before installation, without additional cost.

C. The Contractor shall install his work complete and in good working order. If any of the requirements of the drawings and specifications are impossible to perform, or if the installation when made in accordance with such requirements will not perform satisfactorily, he shall report same to the Architect for correction.

D. No extra compensation will be allowed for extra work or change caused by failure to comply with the above requirements.

1.13 PROJECT RECORD DOCUMENTS

A. Provide the record documents associated with the work of Division 23 in strict accordance with the provisions of these specifications.

B. Throughout progress of the Division 23 Work, maintain an accurate record of changes in the Contract Documents that apply to work of Division 23. Changes shall include all addendums issued during bidding. Maintain an accurate record of the location of mechanical service lines and outlets and all outside utilities.

C. Delegate the responsibility for maintenance of Record Documents to one person on the Contractor's staff as approved by the Architect.

D. Accuracy of Records

1. Thoroughly coordinate changes within the Record Documents, making adequate and proper entries on each page of Specifications and each sheet of drawings and other documents where such entry is required to show the change properly. Match the symbology and format of the base documents.
2. Accuracy of records shall be such that a future verification of items shown in the Contract Documents may rely reasonably on information obtained from the approved Project Record Documents.

E. Maintain the job set of Record Documents completely protected from deterioration and from loss and damage until completion of the work and transfer of all recorded data to the final Project Record Documents.

F. Making Entries on Drawings

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe the change by graphic line and note as required.
2. Date all entries.
3. Call attention to the entry by a "cloud" drawn around the area or areas affected.
4. In the event of overlapping changes, use different colors for the overlapping changes.
5. Make entries within 24 hours after receipt of information that the change has occurred.
6. Maintain the base drawing format and use the same symbology.
7. Convert field mark-ups to finished CADD record drawings when required in this section.

G. Conversion of Schematic Layouts

1. In some cases on the drawings, arrangements of ductwork and piping and similar items are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement subject to the Architect's approval. However, design of future modifications of the facility may require accurate information as to the final physical layout of items which are shown only schematically on the drawings.
2. Show on the job set of record drawings, by dimension accurate to within one inch, the centerline of each run of items such as all sleeves and piping, etc., below grade, in walls, or in the concrete slab. A surface mounted device indicates the exact location:
    a. Clearly identify the item by accurate note such as "Sanitary Sewer" and the like.
    b. Show, by symbol or note, the vertical location of the item "under slab," "in ceiling plenum," "exposed," and the like.
    c. Make all identification sufficiently descriptive that it may be related reliably to the specifications.

H. Final Project Record Documents

1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.

2. Provide CAD electronic files in .dwg format using AutoCAD software. Upon written request, completion of a release form, and payment of the Engineer's standard fee of $200 plus applicable sales tax for a set-up charge and $50 per drawing plus applicable sales tax for copies of such files, Engineer will provide AutoCAD electronic files of base Contract Drawings in dwg format on compact discs. Engineer will also provide a list of drawing layers and names that shall be maintained.
3. Provide completed record drawings on CD-R and one full size hard copy of each drawing.
4. Refer to Division 1 for additional requirements.

1.14 OPERATION AND MAINTENANCE DATA

A. Submit two copies of a preliminary draft of the proposed manual or manuals to the Architect for review and comments. Allow a minimum of ten (10) working days for review.

B. Submit specified number copies of the approved manual to the Architect prior to indoctrination of operation and maintenance personnel.

C. Prepare in accordance with the following standards:

Format:

Size: 8½" x 11"

Paper: White bond, at least 20 lb. weight

Text: Neatly written or printed

Drawings: 11" in height preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within the Manual and provide a drawing pocket inside rear cover or bind in with text.

Flysheets: Separate each section of the Manual with neatly prepared flysheets briefly describing contents of the ensuing section; flysheets may be in color.

Binding: Use heavy-duty plastic or fiber-board covers with binding mechanism concealed inside the manual; 3-ring binders will be acceptable; all binding is subject to the Architect's approval.

Measurements: Provide all measurements in U.S. standard units such as feet-and-inches, lbs, and cfm. Where items may be expected to be measured within ten years in accordance with metric formulae, provide additional measurements in the "International System of Units" (SI).

D. Provide front and back covers for each manual, using durable material approved by the Architect, and clearly identified on or through the cover with at least the following information:

OPERATING AND MAINTENANCE INSTRUCTIONS

Name and Address of Work

Name of Contractor

General subject of this manual

Space for approval signature of the engineer and approval date

E. Contents: Include at least the following:
1. Neatly typewritten index near the front of the manual, giving immediate information as to location within the manual of all emergency information regarding the installation.
2. Complete instructions regarding operation and maintenance of all equipment provided including lubrication, disassembly, and reassembly.
3. Complete nomenclature of all parts of all equipment.
4. Complete nomenclature and part number of all replaceable parts, name and address of nearest vendor, and all other data pertinent to procurement procedures.
5. Copy of all guarantees and warranties issued.
6. Manufacturer's bulletins, drawings, and descriptive data, clearly indicating the precise items included in this installation and deleting, or otherwise clearly indicating, all manufacturers' data with which this installation is not concerned.
7. Such other data as required in other sections of these specifications.

1.15 WARRANTY

A. Contractor shall warranty all equipment and workmanship for a period of one year after date of substantial completion and replace or repair any faulty equipment or installation at no cost to the Owner for such service during this period, all in accordance with requirements of Division 1.

B. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the Owner by law.

C. Warranties shall be in writing in a form satisfactory to the Owner, and shall be delivered to the Owner before final payment is made.

D. Upon completion of the work of Division 23, thoroughly clean all exposed portions of the mechanical installation, removing all traces of soil, labels, grease, oil and other foreign material and using only the type cleaner recommended by the manufacturer of the item being cleaned.

PART 2 - PRODUCTS

2.1 ACCESS DOORS

A. Access doors mounted in painted surfaces shall be of Milcor (Inland-Ryerson Construction Products Company) manufacturer, Style K for plastered surfaces and Style M or DW for non-plastered surfaces. The Style K doors shall be set so that the finished surface of the door is even with the finished surfaces of the adjacent finishes. Access doors mounted on tile surfaces shall be stainless steel materials. Access doors shall be a minimum of 18" x 18" in size.

PART 3 - EXECUTION

3.1 ACCCESS DOORS

A. In fire-rated walls, access door shall be fire rated same as wall.

B. In detention areas provide minimum 16 gauge access door with keyed lock approved by Owner.

3.2 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from the Architect and governmental agencies having jurisdiction.

B. Make written notice to the Architect adequately in advance of each of the following stages of construction:
   1. When all rough-in is complete, but not covered.
   2. As specified in all Division 23 sections.
   3. At the completion of the work of Division 23.

C. When material or workmanship is found to not comply with the specified requirements, remove the noncomplying items from the job site and replace them with items complying with the specified requirements at no additional cost to the Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

3.3 INSTALLATION METHODS

A. Unless noted otherwise, piping and ductwork may be run exposed in mechanical rooms and janitor's closets. Piping and ductwork exposed in mechanical rooms and janitor's closets shall be run tight against the structure, as required by the Architect, allowing for expansion.

B. Conceal piping and ductwork to be installed as hereinbefore specified.

C. Piping suspended from the structure shall be adequately and properly supported on hanger rods or clamps as specified in Section 23 0529 “Hangers and Supports for HVAC Piping and Equipment”. Perforated strap hangers will not be permitted. **The contractor must support all duct, pipe, equipment, and all other items furnished and installed under this scope from steel joists or structural steel frames. It is prohibited to support duct, pipe, equipment, and all other items furnished under this scope from the metal deck.**

D. Where space is limited above ceilings, below concrete beams or other concrete projections, piping shall be sleeved through the beam or projection, rather than hung below. Provide sleeves where required and locate where approved by the Architect.

E. Cut pipe accurately to measurements established at the building and install into position without springing or forcing. All open ends of pipes shall be capped or otherwise closed until the systems are closed with final connections.

F. No pipe joints nearer than 12" to a wall, ceiling or floor penetration will be permitted, unless joint is of the welded type.

G. Piping systems shall be made up straight and true and run at proper grades to permit proper flow of the contained material. Piping shall be graded for proper drainage.

H. Piping shall follow as closely as possible the routes shown on plans, which take into consideration conditions to be met at the site and in the building. Should any unforeseen conditions arise, lines shall be changed or rerouted as required after approval from the Architect.

I. All piping shall be installed with due regard to expansion and contraction and so as to prevent excessive strain and stress in the piping and in connections to equipment.

J. All piping shall be clean when it is installed; rust and/or dirt shall be removed.

K. Screw joints shall be made with taper threads, properly cut. Threads shall be cut using graphite and oil applied to the pipe only. When threads are cut on pipes, the ends shall be carefully reamed to remove any burrs. Pipe shall be up-ended and hammered to remove all shavings and foreign material, before installing.

L. Requirements for assembling joints in cast iron and copper lines are set forth elsewhere in these specifications. For any special materials, consult the manufacturers for the recommended procedures in assembling the joints.

M. This Contractor shall provide wall or ceiling access doors for unrestricted access to all concealed items of the fire suppression system.

N. Install roof pipe penetrations through sleeves, and flash with membrane flashing and roofing mastic compatible with roofing system. Roofing Supplier/Contractor shall approve roof penetration and flashing.

O. For additional installation requirements, refer to individual sections in Division 23.

3.4 CUTTING AND PATCHING

A. Perform cutting and patching associated with the work in strict accordance with the provisions of Division 1 of these Specifications and the following:

1. Coordinate work to minimize cutting and patching work. Cut and patch walls, floors, etc., resulting from work in existing construction or by failure to provide proper openings or recesses in new construction. If cutting and patching is required, it shall be performed by trades specializing in that type work.
2. Perform Architect-approved cutting and demolition by methods which will prevent damage to other portions of the work and provide proper surfaces to receive installation of new work and/or repair.
    a. Openings cut through concrete and masonry shall be made with masonry saws and/or core drills and at such locations acceptable to the Architect. Impact-type equipment will not be used except where specifically acceptable to the Architect.
    b. Openings in precast concrete slabs or walls for pipes, etc., shall be core drilled to exact size. Oversize the hole to allow for link seals, and to deter pipe corrosion condensation from forming.
    c. Where openings are cut through masonry walls, provide and install lintels or other structural supports to protect the remaining masonry. Adequate supports shall be provided during the cutting operation to prevent any damage to the masonry occasioned by the operation. All structural members, supports, etc., shall be of the proper size and shape, and shall be installed in a manner acceptable to the Architect.
    d. Openings cut through plaster or drywall shall be cut prior to plaster finish coat or texture coat on drywall. Cutting of the finish coat of plaster or texture coat of drywall will not be permitted unless written approval of the Architect is obtained.
    e. Openings shall be restored and/or repaired as required to replace the cut surface to an "as-new" and/or "as original" condition. Refer to the appropriate section of the specifications for the material involved.
3. Perform fitting and adjusting of products to provide finished installation complying with the specified tolerances and finishes.
4. Provide all core drilling of holes. Where sleeves and/or blockouts are required, they shall be cut or provided at locations required. On completion of this work or as work progresses, make all repairs and do all patching required as a result of work under this Contract. All patching shall be performed in a manner that will restore the surrounding work to its original condition to the satisfaction of the Architect.
5. Assume responsibility for the proper size of all sleeves and/or blockouts in the building structure pertaining to the work and for providing the correct location of pipe sleeves and/or blockouts.
6. No cutting, boring or excavating which will weaken the structure will be permitted.

3.5 EXISTING UTILITIES AND TEMPORARY SERVICES FOR CONSTRUCTION

A. Verify the location and capacity of existing utility services pertaining to work of Division 21. Relocate existing utilities unearthed by excavation as directed by the utility service companies affected.
    1. Temporary Services for Construction
    2. Provide temporary services in strict accordance with the provisions of these specifications.

B. When any piece of fire suppression equipment is operable and it is to the advantage of the Contractor to operate the equipment, he may do so, providing that he properly

supervises the operation, and has the Architect's written permission to do so. The warranty period shall, however, not commence until such time as the equipment is operated for the beneficial use of the Owner, or date of substantial completion, whichever occurs first.

C. Regardless of whether or not the equipment has or has not been operated, the Contractor shall properly clean the equipment, install clean filter media, properly adjust, and complete all deficiency list items before final acceptance by the Owner. The date of acceptance and performance certification will be the same date.

3.6 DEMOLITION AND RELOCATION

A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the Drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination or otherwise disposed of as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

B. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as hereinbefore specified.

3.7 EXCAVATION AND BACKFILLING

A. Perform all excavation and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them in dry condition until the work has been installed. All shoring required to protect the excavation and safeguard employees shall be properly performed.

B. Perform excavation and backfilling in strict accordance with the provisions of these specifications including trench safety requirements.

C. All excavations shall be made to the proper depth, with allowances made for floor slabs, forms, beams, etc. Ground under piping shall be well compacted before piping is installed.

D. Backfilling shall be made with selected soil, free from rocks and debris and shall be pneumatically tamped with 6 inch layers to secure a field density ratio of 95 percent as defined by ASTM Designation D698-57T (Proctor Soil Compaction Test).

E. Excavated materials not suitable and not used in the backfill shall be removed from the site.

F. Field check and verify the locations of all underground utilities. Avoid disturbing these as far as possible. In the event existing utilities are damaged, they shall be repaired at no cost to

Owner.

G. In a lime stabilized area, the lime stabilization shall be fully restored after the excavation is complete.

H. Replace concrete, curbs, paving and other surface improvements cut during excavation to their original condition.

3.8 JOBSITE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Include required work to correct conditions detrimental to the timely and proper completion of all Division 21 Work. Do not proceed until unsatisfactory conditions are corrected.

B. The Contractor shall at all times take such precautions as may be necessary to properly protect all materials and equipment from damage from the time of delivery until the completion of the work. This shall include the erection of all required temporary shelters and supports to adequately protect any items stored in the open on the site from the weather, the ground and surrounding work; the cribbing of any items above the floor of the construction; and the covering of items in the incomplete building with tarpaulins or other protective covering; the installation of electric heaters in electrical switchgear and similar equipment to prevent moisture damage. Failure on the part of the Contractor to comply with the above will be sufficient cause for the rejection of the items in question.

C. Take particular care not to damage the building structure in performing work. All finished floors, step treads, and finished surfaces shall be covered to prevent any damage by workmen or their tools and equipment during the construction of the building.

D. Equipment and materials shall be protected from rust both before and after installation. Any equipment or materials found in a rusty condition at the time of final inspection must be cleaned of rust and repainted as specified elsewhere in these Specifications.

3.9 STORAGE AND PROTECTION

A. Contractor shall provide the required protection of equipment and materials from the time of delivery until the completion of the Work. Protect from damage, rust, rain, humidity and dust.

B. Do not receive equipment or materials on the jobsite until adequate space has been provided for storage.

C. Provide adequate supports for protection from the ground and erect required shelters for items stored in the open.

D. Items stored within the building are to be adequately protected and covered with tarpaulins or other protective covering.

E. Protect the building at all times during construction from damage by workmen, their tools and/or equipment. Protect floors, steps, wall, ceilings, doors, windows and other finish surfaces.

F. Equipment and materials found in a rusty condition at completion of the work will be thoroughly cleaned of rust and refinished as required to its original condition.

3.10 PREPARATION AND COORDINATION

A. Perform coordination work in strict accordance with provisions of these specifications and the following:

1. Coordinate as necessary with other trades to assure proper and adequate interface with all work.
2. Where pipes or other fire suppression items are shown in conflict with locations of structural members and other equipment, include labor and materials required for extensions, offsets and supports to clear the encroachment.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation of the fire suppression system.

4. Coordinate accepted equipment changes from those scheduled or specified with other trades affected. Additional compensation to other trades for equipment changes is the responsibility of the Contractor making the change.

B. The Mechanical, Electrical, and associated Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

C. When the mechanical and electrical Drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

D. The general installation precedence of materials shall be as follows. Note that if an interference is encountered, this shall guide the contractor in the determination of which trade shall be given the "Right-of-Way".

Building lines
Structural Members
Soil and Drain Piping
Condensate Drains
Vent Piping
Supply, Return, and Outside Air Ductwork
Exhaust Ductwork
Fire Protection Piping
Gas Piping
Domestic Water (Cold and Hot)
Electrical Conduit

E. Where items such as diffusers, thermostats, switches, and control panels are not specifically located on the Drawings, locate as determined in the field by the Architect. Where such items are installed without such specific direction, relocate as directed by the Architect and at no additional cost to the Owner.

F. Verify all dimensions and distances. No additional compensation will be allowed because of differences between work shown on the Drawings and actual dimensions and distances at the jobsite.

3.11 PAINTING

A. All equipment shall be delivered to the job with suitable factory finish. Should the finish be damaged in transit or during the installation, it shall be finished to match appearance of original finish. All work shall be subject to approval by Architect.

B. All equipment, piping, conduit, insulation, etc., furnished and installed in exposed areas under Divisions 23 of these Specifications and as hereinafter specified shall be cleaned, prepared, and painted according to the following specification. In the event of a conflict between the specifications referenced, the provisions of this specification shall prevail only for Division 23 work.

C. Before painting, materials and equipment surfaces shall be thoroughly cleaned of cement, plaster, and other foreign materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out. Exposed metal work shall be carefully brushed down with the steel brushes to remove rust and other spots and left smooth and clean.

END OF SECTION

SECTION 23 0513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general requirements for single-phase and poly-phase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
   1. Motor controllers.
   2. Torque, speed, and horsepower requirements of the load.
   3. Ratings and characteristics of supply circuit and required control sequence.
   4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.

B. Comply with NEMA MG 1 unless otherwise indicated.

C. Provide a shaft grounding ring for motors used in direct-driven VFD motor applications.

D. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3600 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Multispeed Motors: Separate winding for each speed.

F. Rotor: Random-wound, squirrel cage.

G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

H. Temperature Rise: Match insulation rating.

I. Insulation: Class F (non-inverter duty motors).

J. Code Letter Designation:
1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

2.6 MOTOR STARTERS

A. Provide motor starters as manufactured by one of the following:

1. General Electric Company.
2. Siemens Energy and Automation.
3. Square D Schneider Electric.
4. Cutler Hammer.

B. General:
1. Starters furnished as integral parts of factory-assembled, pre-wired equipment shall conform to the requirements of this Section.
2. All controllers shall be provided with a heavy-duty type push-button station, rated for 10 amperes continuous load at 600 volt or less.
3. Enclosures shall be general purpose NEMA Type 1, except that pushbutton stations installed outside the building or otherwise exposed to the weather shall be NEMA Type 3R, dust and weather tight. NEMA Type 4 enclosures shall be provided for surface mounting, except as otherwise indicated.
4. Pushbutton stations for non-interlocking contactors shall be momentary contact type with start button, stop button, and red indicator light. Where required for delayed "seal-in" or where otherwise noted.

C. Manual Motor Starters
1. Provide single-phase, horsepower rated manual motor starters, of sizes and ratings indicated. Equip with manually operated quick-make, quick-break toggle mechanisms; and with one-piece melting alloy type thermal units. Starter to become inoperative when thermal unit is removed. Provide starters with double break, silver alloy contacts, visible from both sides of starter, green pilot lights, and switch capable of being padlocked “OFF”.
2. Provide surface mounted starters in NEMA Type 1 or Type 3 enclosure as required.

D. Magnetic Motor Starters
1. Provide fused disconnect switches complete with time delay fuses.
2. Provide contactors with three overload relays.
3. 120 volt holding coil.
4. Provide pilot light in cover, green type.
5. Provide reset button, and Hand-Off-Automatic switch behind lockable cover, field convertible to Off/Auto or Start/Stop pushbutton.
6. Provide two sets of normally open auxiliary contacts in addition to standard auxiliary holding contacts supplied with each contactor.
7. Provide surface mounted starters in NEMA Type 1 or Type 3 enclosure as required.

E. Combinations Motor Starters
1. Provide fused, 3-pole, load break disconnect switches with RK-1 fuses, rotary operating handle, and lock-off facility.
2. Restrict opening of switch enclosure by the use of a defeater screw, unless switch is in the OFF position.
3. Provide contactors with three overload relays.
4. 120 volt holding coil.
5. Provide pilot light in cover, green.
6. Provide reset button, and Hand-Off-Automatic switch behind lockable cover, field convertible to Off/Auto or Start/Stop pushbutton.
7. Provide two sets of normally open auxiliary contacts in addition to standard auxiliary holding contacts supplied with each contactor.
8. Provide control transformer of sufficient capacity to handle operating coil and associated controls.

PART 3 - EXECUTION

3.1 MOTOR STARTERS

A. Install motor starters as indicated, in accordance with Division 16 and equipment manufacturer's written instructions, and with recognized industry practices complying with applicable requirements of NEC, UL, and NEMA standards.
B. In finished areas, mount motor protection switches flush and install suitable cover plates.
C. Install heaters correlated with full load current of motors provided.
D. Set overload devices to suit motors provided.
E. Install fuses in fusible disconnect switches.

END OF SECTION

SECTION 23 0529
PIPE HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of all necessary identification items as indicated on the drawings and as specified.

B. Work included:
   1. Pipe hangers and supports.
   2. Concrete supports for equipment.
   3. Sleeving for mechanical equipment.

C. Submittals: Provide submittals as required in Section 23 0500 “Common Work Results for HVAC”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

1.4 REFERENCE STANDARDS

A. Automatic Sprinkler Pipe Supports: NFPA 13, Standard for the Installation of Sprinkler Systems.

B. Standpipe System Supports: NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Supports, hangers, anchors, guides and supplementary steel shall be provided for horizontal and vertical piping and shall meet or exceed the ASA Code for Pressure Piping.

B. Rod sizes noted are minimum sizes. The structural integrity of the supports is the responsibility of the Contractor.

C. Hangers Supporting and Contacting Brass or Copper:
   1. 3" and Smaller: Grinnell Fig. CT-109, copper plated, split-ring hanger with adjusters.
   2. 4" and Larger: Grinnell Fig. CT-65, copper plated, clevis hanger with 2 nuts each rod.
   3. Isolate copper or brass from ferrous metals with an approved dielectric material.

D. Hangers Supporting Insulated Lines:

1. Outside Diameter of Insulation 6" or Smaller and all Ferrous Pipe 3" Diameter and Smaller: Grinnell Fig. 108, malleable iron, split type with adjustable swivel and locknut.
2. Outside Diameter of Insulation 7" and Larger and all Ferrous Pipe Larger than 3" Diameter: Grinnell Fig. 260, malleable iron, clevis hanger with two nuts on each support.

E. Protection Shields for Hangers:
1. Galvanized metal shields shall encircle the lower half of the insulation.
2. Provide shields at hangers on dual and low temperature pipes on trapeze type hangers.
3. Provide rigid insulation at all shields and hangers, extending a minimum of 6" each side of hanger.
4. Shield gauges shall be as follows:

Insulation Diameter	U.S.S. Gauge (Galvanized)
Up to 3"	22
3" thru 6"	16
Above 6"	12

F. Supports for Vertical Riser Piping:
1. Provide Grinnell Fig. 261 double bolt riser clamps at each floor. Bear on structure.
2. At 8 feet o.c., 2-hole rigid clamps. Kindorf channels and C-105 straps. Support from vertical surfaces.
3. Brass or copper pipe shall be isolated from support with sheet polyethylene, minimum 1/8" thick.

G. Supports for Vertical and Horizontal Piping in Chases and Partitions:
1. Provide securely anchored supports for pipes serving plumbing fixtures and equipment near the area the pipe penetrates the wall.
2. Supports shall be steel plate, angles or unistruts mounted vertically or horizontally with unistrut clamps P2426, P2008 or P1109.
3. Attach supports to wall or floor construction with clip angles, brackets or other approved anchoring devices.
4. Brass and copper pipe shall be isolated from support with sheet polyethylene, minimum 1/8" thick.

2.2 INSERTS

A. Provide inserts at each hanger as required for concrete support. Avoid interference with concrete reinforcing.
B. Inserts to be malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, and lugs for attaching to forms.
C. Provide reinforcing as required to support load.
D. Size inserts to suit threaded hanger rods.

2.3 HANGER RODS

A. Provide steel hanger rods, threaded both ends, threaded one end or continuous threaded.

B. Size hanger rods as follows:

Pipe Size	Rod Diameter
4" & Smaller	3/8"
5" thru 8"	1/2"
10" & 12"	5/8"
14" & 16"	3/4"

2.4 SLEEVES

A. Provide sleeves where pipes penetrate floors, walls, foundations, fireproofing, etc.

B. Size sleeves large enough to allow for movement due to expansion and to provide for continuous movement. Provide a bead of sealant in space between pipe and sleeve. Use link-seal to seal between pipe and sleeve for all slab on grade floor penetrations.

C. Use Schedule 40 galvanized steel pipe sleeves for all floor and foundation penetrations. Sleeves shall extend minimum of 2" above finished floor and flush with vertical wall surface.

2.5 TRAPEZES

A. Trapezes of Kindorf, Elcen or approved equal may be provided where multiple lines run horizontally at the same elevation.

2.6 CONCRETE SUPPORTS FOR EQUIPMENT

A. Provide concrete pad foundations for the support of equipment such as floor-mounted pumps, air handling units, fans, etc.

B. Unless otherwise noted, concrete pads shall be constructed of not less than 3,000 lb. concrete and not less than 4" high and shall extend on all sides a minimum of 8 inches beyond the limits of the mounted equipment. Pads shall be poured in forms built of new-dressed lumber. All corners of the foundations shall be neatly chamfered 3/4" wide by means of sheet metal of triangular wood strips nailed to the form. Reinforce with No. 4 rebar 6" on center.

C. Foundation bolts, 3/4" round-hooked, shall be placed in the forms when the concrete is poured, the bolts being correctly located by means of templates. Each bolt shall be set in a sleeve of size to provide 1/2" clearance around bolt. Allow 1" below the equipment bases for alignment and grouting. After grouting, the forms shall be removed and the surface of the foundations shall be hand rubbed with carborundum.

D. Foundation pads for equipment located on the exterior of the building shall be provided as indicated.

E. Submit shop drawings of concrete pads for review by the Architect.

2.7 STRAP HANGERS

A. Under no circumstances will perforated strap iron or wire be acceptable for hangers on this project.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTS

A. All pipe supports shall be designed and installed to avoid interferences with other piping, hangers, ducts, electrical conduit, supports, building structure, equipment, etc. All piping shall be installed with due regard to expansion and contraction. The type of hanger, method of support, location of support, etc., shall be governed in part by this specification.

B. Pipe hangers shall be attached to the structure as follows:

1. Poured-in-Place Concrete: Each hanger rod shall be fitted with a nut at its upper end, which nut shall be set into an Underwriters' Laboratories, Inc., listed universal concrete insert placed in the formwork before concrete is poured.
2. Steel Bar Joists: Where pipes and loads are supported under bar joists, hanger rods shall be run through the space between the bottom angles and secured with a washer and two nuts. Where larger lines are supported beneath bar joists, hanger rods shall be secured to angle irons of adequate size. Each angle shall span across two or more joists as required to distribute the weight properly and shall be welded to the joists or otherwise permanently affixed thereto.
3. Steel Beams: Pipes and loads supported under steel beams shall be installed using approved beam clamps.

3.2 SPACING

A. Install hangers for steel piping with the following maximum spacing and minimum rod sizes according to MSS SP 69 Tables 3 and 4:

1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
2. NPS 1: Maximum span, 7 feet; minimum rod size, 3/8 inch.
3. NPS 1-1/4: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 1/2 inch.
7. NPS 3: Maximum span, 12 feet; minimum rod size, 1/2 inch.
8. NPS 3-1/2: Maximum span, 13 feet; minimum rod size, 1/2 inch.
9. NPS 4: Maximum span, 14 feet; minimum rod size, 5/8 inch.
10. NPS 5: Maximum span, 16 feet; minimum rod size, 5/8 inch.
11. NPS 6: Maximum span, 17 feet; minimum rod size, 3/4 inch.
12. NPS 8: Maximum span, 19 feet; minimum rod size, 3/4 inch.
13. NPS 10: Maximum span, 22 feet; minimum rod size, 7/8 inch.
14. NPS 12: Maximum span, 23 feet; minimum rod size, 7/8 inch.
15. NPS 14: Maximum span, 25 feet; minimum rod size, 1 inch.
16. NPS 16: Maximum span, 27 feet; minimum rod size, 1 inch.
17. NPS 18: Maximum span, 28 feet; minimum rod size, 1 inch.
18. NPS 20: Maximum span, 30 feet; minimum rod size, 1-1/4 inches.

B. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 5 feet; minimum rod size, 3/8 inch.
2. NPS 5/8: Maximum span, 5 feet; minimum rod size, 3/8 inch.
3. NPS 1: Maximum span, 6 feet; minimum rod size, 3/8 inch.
4. NPS 1-1/4: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.

7. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

C. Spacing and rod sizes for other piping materials shall be as recommended by the manufacturer.

3.3 TRAPEZES

A. Trapeze members, including suspension rods, shall be properly sized for the number, size and loaded weight of the lines they are to support. Install as noted above.

3.4 HANGERS AND SUPPORTS

A. All hangers and supports for fire standpipe systems and fire sprinkler systems shall be Underwriters' Laboratories, Inc. approved types.

3.5 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations associated with the work in accordance with the provisions of these specifications.

B. Provide concrete bases for all pad or floor mounted equipment.

3.6 MISCELLANEOUS

A. Install any other special foundations, hangers and supports indicated on the drawings, specified elsewhere, or required by installation conditions.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. The extent of vibration isolation work is indicated by drawings and schedules, and by the requirements of this section.

B. The types of vibration isolation work specified in this section include the following:
   1. Support isolation for motor-driven mechanical equipment.
   2. Isolation including support isolation for piping risers.
   3. Support isolation of piping.
   4. Flexible connections for piping at equipment.

C. Refer to other sections of these specifications for equipment foundations, hangers, sealants, gaskets, flexible connections for piping, and other work related to vibration isolation work.

1.3 QUALITY ASSURANCE

A. Product Qualification: Provide each type of vibration isolation unit produced by a specialized manufacturer, with not less than 5 years' successful experience in the production of units similar to those for the project.
   1. Except as otherwise indicated obtain support isolation units from a single manufacturer.
   2. Engage the manufacturer to provide technical supervision of the installation of support isolation units produced by him, and of associated inertia bases (if any).

B. Manufacturer: Acceptable vibration isolation support unit manufacturers are as follows:
   1. Mason Industries, Inc.
   2. Vibration Mountings and Controls, Inc.
   3. Amber Booth
   4. Peabody Kinetics

C. Manufacturer Certification: Where vibration isolation support units are indicated for a minimum static deflection, provide manufacturer's certification that units have been tested and comply with the indicated requirements.

D. All items of equipment, whether suspended, floor mounted or otherwise supported, which are capable of producing vibration, shall be installed with vibration isolation. The isolation shall prevent the transmission of objectionable noise or vibration to the building structure.

E. Submit for approval data showing disturbing frequency, supported weight, static deflection or natural frequency, and calculations supporting same for each isolator.

1.4 SUBMITTALS

A. Manufacturer's Data, Vibration Isolation:
   1. For information only, submit 2 copies of manufacturer's specifications, detailed drawings, performance characteristics data and installation instructions for each type of unit required.
   2. Include data for each type and size of unit, showing isolation efficiency, stiffness, natural frequency and transmissibility at lowest operating speed of equipment.
   3. Where required, include independent test agencies certified report of test results for each type of unit.

4. For spring units, show wire size, spring diameter, free height, solid-compression height, operating height, fatigue characteristics and ratio of horizontal to vertical stiffness.
5. For spring-and-pad-type units show basis of spring-rate selection for range of loading weights.
6. Include performance certifications where required.

PART 2 - PRODUCTS

2.1 ISOLATION MATERIALS AND SUPPORT UNITS

A. Double deflection neoprene mountings shall have a minimum static deflection of 0.35". All metal surfaces shall be neoprene covered to avoid corrosion and have friction pads both top and bottom so they need not be bolted to the floor. Bolt holes shall be provided where bolting is required. On equipment such as small vent sets and close coupled pumps, steel rails shall be used above the mountings to compensate for the overhang.

B. Vibration hangers shall contain a steel spring and 0.3" deflection neoprene element in series. The neoprene element shall be molded with a rod isolation bushing that passes through the hanger box. Spring diameters and hole sizes shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short-circuiting the spring. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection.

C. Vibration hangers shall be as described above, but they shall be precompressed to the rated deflection so as to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be indicated by a scale.

D. Vibration hangers shall contain a steel spring located in a neoprene cup manufactured with a grommet to prevent short-circuiting. The cup shall contain a steel washer designed to properly distribute the load on the neoprene and prevent its extrusion. Spring diameters and hole sizes shall be large enough to permit the hanger rod to spring through a 30 degree arc before contacting the hole and short circuiting the spring. Springs shall have as minimum additional travel to solid equal to 50% of the rated deflection. Hangers shall be provided with an eyebolt on the spring end and provision to attach the housing to the flat iron duct straps.

E. Vibration isolator shall be steel members welded to height saving brackets to cradle machines having legs or bases that do not require a complete supplementary base. Members shall be sufficiently rigid to prevent strains in the equipment.

F. Flexible neoprene connectors shall be used on all equipment as indicated on the drawings. They shall be manufactured of multiple plies of nylon tire cord fabric and neoprene. No steel wire or rings shall be used as pressure reinforcement. Straight connectors shall have two spheres. Neoprene elbows shall have a single sphere forming the corner of the joint itself. Connectors up to and including 2" diameter may have threaded ends. Connectors 2-1/2" and larger shall have floating steel flanges. All connectors shall be rated a minimum of 150 psi at 200 degrees F. All sizes operating at pressures above 100 psi shall employ control cables with end fittings isolated from the anchoring plates by means of 1/2" thick bridge bearing neoprene washer bushings designed for a maximum of 1000 psi.

G. Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3" and larger shall be flanged. Smaller sizes shall have male nipples. Lengths shall be as tabulated:

Flanges		Male Nipples	
3 x 14	10 x 26	1/2 x 9	1-1/2 x 13
4 x 15	12 x 28	3/4 x 10	2 x 14
5 x 19	14 x 30	1 x 11	2-1/2 x 18
6 x 20	16 x 32	1-1/4 x 12	
8 x 22			

H. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be type BSS.

I. Where piping passes through equipment walls, floors or ceilings, the vibration isolator shall be a split seal consisting of two bolted pipe halves with 3/4" or thicker neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1" past either face of the wall. Where temperatures exceed 240 degrees F., 10# density fiberglass may be used in lieu of the sponge.

J. Isolator pads shall be neoprene waffle rated for 60#/sq. in.

K. Pipe Riser Isolators: Provide manufacturer's standard pad-type isolator bonded to steel plate, formed for welding to pipe sleeve extension.

PART 3 - EXECUTION

3.1 PERFORMANCE OF ISOLATORS

A. General: Comply with the minimum static deflections recommended by ASHRAE, including the definitions of critical and non-critical locations, for the selection and application of vibration isolation materials and units as indicated.

B. Manufacturer's Recommendations: Except as otherwise indicated, comply with manufacturer's recommendations for selection and application of vibration isolation materials and units.

3.2 APPLICATIONS

A. General: Apply the types of vibration isolation materials and units indicated at the locations shown or scheduled. Selection is Contractor's option where more than one type is indicated.

B. Provide Neoprene Pads at the following locations/items of equipment:
   1. Where shown on drawings.

C. Provide Vibration Isolation Springs for the following items of equipment:
   1. Where shown on drawings.

D. Provide Spring Isolator, housed at the following items of equipment:
   1. Where shown on drawings.

E. Provide Isolation Hangers for the following:
   1. Piping connected to machinery.

3.3 INSTALLATION

A. General:

1. Except as otherwise indicated, comply with manufacturer's instructions for the installation and load application to vibration isolation materials and units.
2. Adjust to ensure that units do not exceed rated operating deflections or bottom out under loading, and are not short-circuited by other contacts or bearing points.
3. Remove spacer blocks and similar devices (if any) intended for temporary protection during shipping or against overloading during installation.
4. Anchor and attach units to substrate and equipment as required for secure operation and to prevent displacement by normal forces, and as indicated.
5. Adjust leveling devices as required to distribute loading uniformly onto isolators. Shim units as required where leveling devices cannot be used to distribute loading properly.
6. Install inertia base frames on isolator units as indicated, so that a minimum of 2" clearance below base will result when frame is filled with concrete and supported equipment has been installed and loaded for operation.
7. Locate isolation hangers as near the overhead support structure as possible.
8. Weld riser isolator units in place as required preventing displacement from loading and operations.

3.4 EXAMINATION OF RELATED WORK

A. Installer of vibration isolation work shall observe the installation of other work related to vibration isolation work, including work connected to vibration isolation work; and, after completion of other related work (but before equipment startup), shall furnish a written report to the Contractor listing observed inadequacies for proper operation and performance of vibration isolation work. Report shall cover, but not necessarily be limited to the following:

1. Equipment installations (performed as work of other sections) on vibration isolators.
2. Piping connections including flexible connections.
3. Passage of piping which is to be isolated through walls and floors.

B. Do not start-up equipment until inadequacies have been corrected in a manner acceptable to the vibration isolation Installer.

3.5 DEFLECTION MEASUREMENTS

A. Upon completion of vibration isolation work, take measurements and prepare a report showing measured equipment deflections for each item of equipment.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of all necessary identification items as indicated on the drawings and as specified.

B. Work included:
   1. Valve tagging
   2. Pipe marking
   3. Equipment marking

C. Submittals: Provide submittals as required in Section 23 0500, “Common Work Results for HVAC”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified. Marking system shall conform to ASME 13.1, latest edition and OSHA 29 CFR 1910.261 requirements.

PART 2 - PRODUCTS

2.1 VALVE TAGS

A. Provide a tag for each valve in main and branch piping of natural gas and refrigerant piping systems.
   1. Tags shall be 1-1/2" diameter of solid brass with blacked filled stamped characters of 1/4" height above and 1/2" height below.
   2. Provide 8" long meter seals for use with valve tags.

B. Provide a valve chart with a schedule and location plans for all identified equipment, both in a frame with an acrylic cover to be located as directed by the Architect.

2.2 PIPE MARKERS

A. Provide pipe markers for pipes that provide 360 degree visibility with ANSI approved color coded background, color of legend in relation to background color, legend letter size, and length of color field. Additionally, direction of flow arrows shall be printed on the same markers, and words shall be repeated and reversed for use with flow in either direction.
   1. Each marker shall be formed with a clear acrylic covering suitable for use outdoors.

2. For diameters 3/4" to 6", marker shall be formed in order to snap on and completely surround the pipe. For diameters 6" and larger, provide radius formed markers of same material.

2.3 EQUIPMENT PLATES

A. Plate shall be black with white letters that appear when the plate is engraved.

B. Plate material shall be specifically suited for conditions surrounding the equipment. Outdoor equipment shall require special plate material for outdoor use.

C. Plate size shall be as required with lettering size appropriate for the information shown but in no case less than 1/8" high. Lettering style shall match existing facility standards.

D. Nomenclature for plates shall be based on the equipment designations shown on the equipment schedules and as approved by the Architect.

2.4 CONCEALED DEVICES

A. Operable devices and equipment located above ceilings shall be marked with color coded W. H. Brady "Tack" type markers.

2.5 MANUFACTURERS

A. Provide marking system as manufactured by W. H. Brady Company, Seton, Craftmark, or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Place all markers and plates in such locations that they are easily read by a person without assuming awkward or hazardous positions.

3.2 VALVE TAGS

A. Secure one valve tag to each valve.

3.3 PIPE MARKERS

A. For diameters 3/4" to 6", markers shall snap around the pipe, completely surrounding the pipe. Markers shall not require taping or the use of any adhesive material or fasteners to permanently secure them to the pipe. For diameters 6" and larger, secure with stainless steel spring fasteners.

B. Install sufficient quantities of markers that tracing of pipe systems can be readily accomplished. Install within three feet before and/or after penetrations through walls, floors, ceilings, underground or other non-accessible enclosures; at access doors, manholes or other access points which permit view of concealed piping; and when there is a change in direction of the concealed pipe. Locations in major mechanical rooms shall be labeled at a maximum spacing of every 20 feet. Other piping shall have labels at a maximum spacing of every 30 feet and at least once in every area that the pipe passes over or through. Install additional markers where directed by the Architect.

3.4 EQUIPMENT PLATES

A. Provide engraved plates for all HVAC equipment and all remote mounted starter/disconnects.

B. Secure all plates with two self-tapping metal screws with round heads. Alternately, plates may be fastened with "pop" rivets provided no cracking or injury occurs to the plate. Plates attached with adhesives shall not be permitted.

END OF SECTION

SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Testing and Balancing Agency Qualifications

1. The testing, adjusting, and balancing of the heating, ventilating and air conditioning systems shall be performed by a technical firm or balancing agency certified in Air and Hydronic TAB and system commissioning by the Associated Air Balance Council (AABC). The TAB agency shall also employ a permanent full time Registered Professional Engineer on staff with a minimum of five years specialized experience in testing and balancing. The testing and balancing agency shall possess calibrated instruments, qualified engineers, and skilled technicians to perform required tests in accordance with the AABC National Standards.
2. The testing and balancing agency shall be an independent firm separate and distinct from; not to be associated with, or be subsidiary of a firm performing work under other Sections of Division 22 & 23 and shall be under contract directly to the Owner.

B. Testing and Balancing Agency Responsibilities

1. Submittals
   a. Engineer and Technicians Data: Submit proof that the agency, the Test and Balance Engineer assigned to supervise the procedures, and the technicians proposed to perform the procedures meet the qualifications specified.
   b. Sample Form: Submit sample forms, proposed for use on this project, for approval.
   c. Certified Reports: Submit testing, adjusting, and balancing reports bearing the seal and signature of the Certified Agency.
2. Review the construction documents, submittal, and shop drawings for balance ability. Submit a list of suggestions or recommendations to the Architect/Engineer for consideration.
3. Perform a job site observation prior to the ceiling installation to verify that ductwork, piping, dampers, valves, and air terminal devices have been installed per the contract documents. Submit in writing to the Architect/Engineer a list of any discrepancies noted.
4. Test, adjust and balance the heating, ventilating, and air conditioning systems in accordance with AABC National Standards for field measurement.
5. Verify the operation, calibration, and set points of all heating, ventilating, and air conditioning systems controls.
6. Functional performance tests of the control and smoke purge system and its components.
7. Submit in writing to the Architect/Engineer a list of deficiencies for correction by the installing contractor. In the event a deficiency remains after being reported as corrected, the balancing agency may submit an itemized request for its lost time for payment by the installing contractor. All deficiencies that prevent proper T&B work from being completed shall be corrected prior to submittal of the Final T&B Report.
8. Measure and record space temperature readings after occupancy for a period of

two consecutive eight hour periods. Make adjustments if necessary to achieve an even temperature distribution.

9. Submit six copies of a certified, bound, typewritten report for approval by the Owner and Architect/Engineer including all test report data, instrument calibration, and schematic drawings of the HVAC layout.
10. Provide preliminary smoke testing and smoke testing for all authorities having jurisdiction. Preliminary smoke testing must be completed in the presence of the architect/engineer and must be completed a minimum of 14 days prior to any smoke tests scheduled for authorities having jurisdiction. **Provide all materials required to perform smoke tests.**
11. Make a total of three inspections within 90 days after occupancy of the building to insure that satisfactory conditions are being maintained. Submit a report of the findings to the Owner and Architect/Engineer.
12. Make an inspection in the building during the opposite season from which the initial adjustments were made. At that time, make any necessary modifications to the initial adjustments required to produce optimum operation of the system for all seasons. Submit a report of the findings to the Owner and Engineer.

C. Contractor Responsibilities

1. The Contractor shall provide the T&B firm with copies of all Drawings, Specifications, Shop Drawings, Submittal Data, Up-to-Date Revisions, Change Orders, and other data required for planning, preparation and execution of the T&B work.
2. Coordinate the HVAC installation and start up schedule with the T&B Agency and General Contractor to allow sufficient time prior to the completion date for testing and balancing to be conducted and deficiency items corrected and retested. Provide sufficient personnel and utilities to operate the HVAC systems during normal and overtime hours to meet the completion date and testing and balancing schedule.
3. The Mechanical Contractor shall install all systems complete and provide balancing valves, test plugs, thermometer wells, flow measurement orifices, volume dampers, splitter dampers, etc. necessary for T&B work. All equipment shall be operated at the Contractor's expense for a minimum of three consecutive days prior to balancing in order to make certain the equipment is free from mechanical defects, runs smoothly and quietly, and performs satisfactorily to meet the requirements set forth in the contract documents.
4. Provide written notification to the T&B agency and General Contractor the systems are ready for balancing. Should the systems not be ready for balancing, it shall be the Contractor's responsibility to compensate the T&B Agency for time lost.
5. Correct any deficiency items noted during testing and balancing including controls calibration, installation of balancing devices, sheave replacements, and motor replacements at no additional cost to the Owner. Provide written notification to the Testing and Balancing Agency and General Contractor when systems are ready for retesting. Should the systems not be ready for retesting it shall be the Contractors responsibility to compensate the T&B Agency for time lost.
6. It shall be the responsibility of the Contractor to install all valves, dampers, and other adjustment devices in a manner that will leave them accessible and readily adjustable.
7. The Control Contractor shall provide and install the control system, complete with all temperature, pressure and humidity sensors installed and calibrated for accurate control.
8. Perform all tests of plumbing and piping systems and equipment as specified herein and as required to obtain approvals from all authorities having jurisdiction.
9. Provide all instruments, materials and labor to perform the testing and to obtain and record all measurements.

10. The Contractor is to perform duct leakage testing in accordance with the latest edition of the SMACNA - HVAC Air Duct Leakage Test Manual and maintain a log book on site indicating the area tested, date tested, leakage amount, and personnel performing the test. At the end of the project submit a final type written report with the results. The test and balance agency is to be notified one week prior to duct leakage testing and at their option witness the testing to confirm the testing is being performed in accordance with these specifications.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. The balancing agency shall have a complete set of instruments as required by AABC standards.

B. Calibration histories for each instrument used for measurement shall be available for examination. Calibration, accuracy, and maintenance of all instruments shall be in accordance with AABC standards.

PART 3 – EXECUTION

3.1 CLEANING AND ADJUSTING

A. Equipment, piping, valves, fittings and fixtures shall be cleaned of grease, metal cuttings and foreign matter that may have accumulated from operation of the system during the test. Any stoppage, discoloration or other damage to the finish, furnishings or parts of the building, due to the Contractor's failure to properly protect such items shall be repaired by the Contractor without additional cost to the Owner.

B. When the work is complete, the water systems shall be adjusted for all required flows. Flush valves and automatic control devices shall be adjusted for proper operation. Hot water heaters shall be tested for proper operation of all safety and operating controls as recommended by the manufacturer. Demonstrate that supply and recirculation systems are balanced for specified flows and temperatures and as shown on the drawings.

C. Sterilization: After pressure tests have been made, the entire domestic water distribution system shall be thoroughly flushed with water until all entrained dirt and mud have been removed, and shall be sterilized by chlorinating material. The chlorinating material shall be either liquid chlorine conforming to Federal Specification BB-C-120 or hypochlorite conforming to Federal Specification 0-C-114, Type II, Grade B, or Federal Specification 0-S-602, Grade A or B. The chlorinating material shall provide a dosage of not less than 50 parts per million and shall be introduced into the system in an approved manner. The treatment water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 10 ppm of residual chlorine at the extreme end of the system at the end of the retention period.

D. All valves and faucets in the system being sterilized shall be opened and closed several times during the contact period. The system shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. Samples of water shall be taken from several points in the system in properly sterilized containers for bacterial examination. The sterilizing shall be repeated until tests indicate the absence of pollution for at least two full days. The system will not be accepted until satisfactory bacteriological results have been obtained.

3.2 EQUIPMENT AND SYSTEM TESTS

1. General: The Test and Balance firm shall test all HVAC equipment and systems and make final adjustments and corrections necessary to place the systems in proper operating condition.

2. After testing and balancing, patch insulation, ductwork, and housings, using

materials identical to those removed. Air test drilled openings shall be sealed with plastic plugs to allow future access. Seal insulation to re-establish integrity of the vapor barrier.

3. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices to show final settings.

B. Air Distribution Devices:

1. Proportion each air handling unit, damper, register, diffuser and grille so that air distribution will be as scheduled, with tests showing air quantities indicated for each inlet and outlet that do not vary by more than plus or minus 10 percent from those indicated on the drawings.

C. Ductwork:

1. The contractor shall perform duct leakage testing on 25% of the supply, return and exhaust ductwork in accordance with SMACNA - HVAC Air Duct Leakage Test Manual. Seal any ductwork not meeting the following acceptable leakage rates and retest until test is successful.

Duct System	Allowable % Leakage
Low Pressure Supply	2% @ construction pressure class
Low Pres. Return/Exhaust	2% @ construction pressure class
Smoke Exhaust	2% @ construction pressure class

D. Gas System:

1. The complete gas piping system shall be tested with air at a pressure of fifteen (15) PSI and proved tight at such pressure for twenty-four (24) hours. Test may be done in segments as dictated by construction requirements.
   Peppermint fumes or soap bubbles shall be used to locate leaks. All tests shall be approved by the local authorities and reviewed by a representative of the Architect before the tests are removed.

E. Fan Balancing:

1. Provide proper fan design and balance fans and drives to limit vibration (displacement in mils) at operating speed to the values in the following table unless specified elsewhere. Measure vibration at each fan bearing, in all three planes.

FAN VIBRATION CRITERIA

Fan RPM (peak-to peak)	Mils (in each plane)
500	4.2
800	3.0
1200	2.0
1700	1.5
2000 and greater	1.3

3.3 SYSTEM OPERATING TESTS

A. After the successful completion of all equipment start-up and test requirements, the following formal testing and balancing shall be performed on the complete mechanical system:

1. Temperature Controls - The balancing agency shall be assisted by the temperature controls contractor in the commissioning of the operation and calibration of all temperature control systems. The following tests are required:
   a. Verify all controlling devices are calibrated and set for design operating conditions.
   b. Verify all components are installed and functional.
   c. Verify the accuracy of each temperature sensor by temperature measurement.
   d. Check the sequence of operation for all control modes to ensure that they are in accordance with the contract documents.

e. Verify that default setpoints are correct if different from the normal operating set points.
f. Verify all interlock systems function.
g. Perform all system verifications to assure the safety of the system and its components.
h. Verify changeover from heating to cooling occurs as specified.
i. Calibrate and adjust all thermostats and other controlling devices.
j. Replace defective controllers at no cost to the Owner.

2. Mechanical Contractor Responsibility
   a. Final Operating Test: An operating test shall be performed by the Contractor to the satisfaction of the Architect and the Owner for a period of not less than 8 hours. Should any element of the system not perform properly, the Contractor shall make all required corrections, and the test shall be repeated until successfully performed

3.4 AIR SYSTEM PROCEDURES

A. The balancing agency shall perform the following testing and balancing functions in accordance with the AABC National Standards for TAB.
   1. Diffusers and Grilles - Determine air velocity at outlets with a velometer or anemometer and using air device manufacturer's data, calculate the delivery cfm, or determine cubic feet per minute flow with a test hood.
   2. Fans - Test supply, return, exhaust fans and adjust fan blower speeds to achieve specified CFM.
   3. Current and Voltage - Measure and record motor full load amperage and voltage. Actual amperages higher than nameplate full load amps are not acceptable. Verify heater sizes.
   4. Pitot-tube Traverse - Perform a Pitot-tube traverse (minimum of 16 points) on main supply and return ducts to obtain design CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used with an explanation why a traverse was not conducted.
   5. Outside Air - Test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and mixed air temperatures when the temperature differential between the return and outside air is greater than 20^{o}F.
   6. Static Pressure - Test and record system static pressures, including entering and leaving static pressures of each fan, coil section, and filter section. For VAV systems, establish and record the minimum operating static pressure setpoint required for the air handling unit to achieve design airflow at the last terminal box in the system.
   7. Air Temperature - Take wet bulb and dry bulb air temperatures on the entering and leaving side of each cooling coil. Dry bulb temperature shall be taken on the entering and leaving side of each heating coil.
   8. Main Ducts - Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
   9. Branch Ducts - Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one volume damper completely open.
   10. Tolerances
      a. Test and balance each diffuser, grille and register to within 10% of design requirements.
      b. Test and balance each fan and air-handling unit to within plus 10% and minus 5% of design requirements. Test and balance units having filters with clean filters in place.
   11. Minimizing Drafts - Adjust all diffusers, grilles, and registers to minimize drafts in all areas.
   12. If inspections or tests reveal defects, such defective work or material shall be

replaced or repaired as necessary and inspections and tests shall be repeated. Repairs to piping shall be made with new materials. Patching of screwed joints or holes shall not be acceptable.

3.5 TEST AND BALANCE REPORT

A.. The Final TAB Report shall be typewritten on 8.5 x 11 inch white bond paper, in bound form with an index and tabs to segregate the data into logical sections. The summary shall include information on special testing conditions and results. A listing of the TAB Agency, Contractor, Owner, Architect, and Engineer shall be included.

B. The report shall present data entered on AABC standard forms (modified as necessary to include additional data hereinafter required) or pre-approved acceptable equivalent thereof.

C. The report shall contain copies of pump curves, fan curves, field test reports and as-built plans (size 11 x 17 inches) of the HVAC systems.

D. Include a certification sheet containing the seal and name, corporate address, telephone number, and signature of the Certified Test and Balance Engineer.

E. Include a listing of the instrumentation's used for the procedures along with the proof of calibration.

F. System Identification - Each supply, return, and exhaust opening shall be identified and numbered on reduced plans no larger than 11 x 17 inches to correspond to the numbers used on the report data sheets.

G. Air Outlet Test Report Forms - Each grille, diffuser, and register shall be identified as to location (room number) and area served. Record the size, type, and manufacturer of each diffuser, grille, and register.

H. Air Handling Unit Test Report Forms - Record the manufacturer, model number and motor nameplate data and all design and manufacturer-rated data including supply, return, and outside airflows, fan rpm, sp, and bhp. Report the following.

1. Total actual CFM by traverse. Include duct traverse form. If not practical, the sum of the outlets may be used, or a combination of each of these procedures.
2. Inlet and outlet static pressures at the fan, coil and filter sections.
3. Actual outside air and return air total CFM.
4. Actual operating current, voltage, and brake horsepower of each fan motor.
5. Final RPM of the fan and motor.
6. Fan and motor sheave sizes and center distance. Belt size and quantity.
7. For VAV air handling systems, report the minimum static pressure set point required to achieve design CFM to the last terminal box in the system while maintaining design airflow at the air handler.
8. Coil EAT and LAT (db/wb), EWT, LWT, and air pressure drops.
9. Outside air temperature (DB/WB).

I. Fan Test Report Forms - Record the manufacturer, model number, motor nameplate data and all design and manufacturer-rated data. Report the following.

1. Total actual CFM by traverse. Include duct traverse form. If not practical, the sum of the outlets may be used, or a combination of each of these procedures.
2. Suction and discharge static pressure of each fan.
3. Actual operating current, voltage, and brake horsepower of each fan motor.
4. Final RPM of the fan and motor.
5. Fan and motor sheave sizes and center distance. Belt size and quantity.

J. Pumps Test Forms - Submit pump curve showing design, operating, and no-flow points of operation. Also, record the following items on each pump test form:

1. Manufacturer, size, and serial number.
2. All design and manufacturer's rated data.
3. Pump operating suction and discharge pressure and final total dynamic head and apparent GPM.
4. No flow (pump discharge valve closed) suction and discharge pressure and corresponding total dynamic head.
5. Rated and actual operating current, voltage, RPM, and brake horsepower of

each pump motor.

3.6 FINAL JOB MEETING

A. At job completion, all Division 21, 22, 23, 26, and 28 representatives shall meet at the job site and shall demonstrate the operation of all equipment and systems. The Architect and Owner shall be advised in writing 10 days prior to the time and date of this inspection.

3.7 SYSTEM PERFORMANCE VERIFICATION:

A. Testing and Balancing Agency

1. At the time of final inspection, the Test and Balance Agency may be required to recheck, in the presence of the Owner's representative, specific and random selections of data, air quantities, and air motion recorded in the Certified Report.
2. Points and areas for recheck shall be selected by the Owner's representative.
3. Measurement and test procedures shall be the same as approved for work forming basis of Certified Report.
4. If random tests elicit a measured flow deviation of 10% or more from that recorded in the Certified Report the report will be rejected, all systems shall be retested, new data recorded, new Certified Report submitted, and new inspection tests made, at no additional cost to Owner.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 23 0700
HVAC INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the insulation of the mechanical systems as indicated on the drawings and as specified herein.

B. Factory insulated equipment is excluded from this section of the specifications except that the insulating material characteristics shall equal or exceed those of specified materials for similar service.

C. Work Included:
   1. Piping:
      a. Cooling coil condensate drain lines.
      b. Refrigerant suction lines.
   2. Ductwork:
      a. Supply air:
         1) Insulate externally with thermal duct wrap.
      b. Return air:
         1) Insulate externally with thermal duct wrap.
      c. Make-up air duct:
         1) Insulated externally.
      d. All round ductwork exposed to view shall be double wall factory internally insulated with 1" thick glass fiber duct and fittings.

D. Submittals: Provide submittals as required in Section 23 0500, “Common Work Results for HVAC”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

D. Acceptable Manufacturers:
   1. Fiberglass Insulation:
      a. Owens-Corning Fiberglas
      b. Manville
      c. Certain Teed

2. Urethane Insulation:
   a. Armstrong (Armalok)
   b. Thermacor
3. Mastics:
   a. Benjamin Foster
   b. Insul-Coustic
   c. Chicago Mastic
   d. Childers Products
4. High Temperature Bonding Cements: Ryder Thermocote
5. PVC Fittings: Zeston, Inc.

1.4 GENERAL

A. All materials shall be applied by workmen skilled in this trade. Mechanical fasteners shall be used whenever possible to assure permanent construction. Unsightly work shall be cause for rejection.

B. Materials will be applied only after all surfaces have been tested and cleaned.

C. All material, jacket, coverings, sealers, mastics and adhesives shall not exceed flame spread rating of 25 and smoke developed of 50 in accordance with ASTM Method E84, UL Standard 723 and NFPA Bulletins 255 and 90A.

D. Insulation shall be vermin resistant.

E. Non-compressible insulation material shall be installed at hangers of cold piping to eliminate through metal conductance.

F. Sizing, paint, pipe shield or saddle, and internal duct insulation shall be provided under other sections of Division 23.

G. Insulation of cold surfaces shall be vapor sealed.

H. Minimum thickness of insulation shall be as listed or energy code as adopted by authority having jurisdiction. However, sufficient insulation shall be provided to eliminate condensation on the cold surfaces and to maintain a maximum exterior insulation surface of 125ºF. (OSHA Standard) on the hot surfaces.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS

A. Pipe Insulation:
   1. Above ground-Johns Manville AP-T preformed one-piece fiberglass with reinforced craft paper and aluminum foil jacket. Include vapor barrier where required.
      a. Use pre-formed PVC fitting covers with fiberglass inserts. Fiberglass shall be same density as pipe insulation.
      b. Where insulation is exposed to weather, use Manville Flame-Safe ML, or approved equal, Metal-Jacketed Fiberglass pipe insulation. Attachment shall be made by 1/2" 0.020 aluminum bands with approved closure system.
   2. Armstrong Armaflex or equal may be used, in thermally equivalent thicknesses, but only for refrigerant suction lines where codes permit.
   3. Condensate drain lines shall be insulated from AC unit to indirect waste termination points and first 10'-0" of horizontal drain line at floor drains receiving condensate. Material shall be closed cell type with 3/4" thick molded pipe covering with a density of 7 lbs. thermal conductivity at 0.28 at 75ºF. Do not split the insulation. All joints shall be glued with manufacturer's adhesive.

2.2 DUCTWORK SYSTEMS

A. External insulation for metal ductwork (flexible blanket): Johns Manville Microlite fiberglass duct wrap with FSK reinforced craft paper and aluminum foil facing, conforming to the requirements of NFPA 90A and 90B.

B. High velocity ductwork with external insulation shall be insulated with blanket wrap fiberglass insulation, 1-1/2 inches thick, one (1) pound density or minimum thermal resistance of 6.0, complete with scrim kraft jacket. Facing overlapping joints shall be at least two (2) inches and held in place with outward clinching staples on approximately four (4) inch centers. Underside of ducts exceeding 24 inches in diameter shall be spot cemented and finally secured with sheet metal screws and washers.

C. High velocity flexible ductwork shall be UL 181, Class I, with rating to meet or exceed NFPA 90A-90B and reinforced with a perforated sheet metal inner jacket.

D. High velocity ductwork located in non-conditioned spaces shall be insulated with 2" thick fiberglass board insulation with vapor barrier jacket.

E. Other manufacturers are Certainteed, Knauf, and Owens Corning or approved equal.

F. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."

1. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. CertainTeed Corporation; Insulation Group.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Owens Corning.
2. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
3. All duct liner products shall avoid air erosion up to velocities of 4,000 feet per minute.

G. Solvent-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.

2.3 ADHESIVES

A. Water based, polymeric, UL classified lagging adhesive for applying canvas and glass cloth; Foster 30-36 or Childers CP-50.

B. A fast setting, rubber based, UL classified, vapor barrier lap and attachment adhesive; Foster 85-15 or Childers CP-85.

C. Same adhesive, except non-flammable when wet; Foster 85-20 or Childers CP-82.

D. A rubber based, UL classified, fast setting contact adhesive for adhering flexible cellular insulation; Foster 82-40 or Armstrong 520.

2.4 INSULATION THICKNESS

A. Piping insulation thickness based on a maximum k value of 0.23 Btu in/hr ft² °F at a mean temperature of 75°F.

Pipe Sizes			
System	**Runouts To 12 ft. Max.**	**1 1/2 " and Less**	**1 1/2" Up**
Refrigerant piping	1"	1"	2"
Condensate drain piping	1"	1"	1"

B. Exterior Duct Insulation: All supply, return and outside air ductwork, shall be insulation 2" thick, with a minimum installed R value of 6.0.

2.5 DUCT SEALANTS

A. A fast setting, rubber based, UL classified, high velocity duct sealer; Foster 32-14 or 3M EC-800.

B. Same sealer, except non-flammable when wet; Foster 30-02.

2.6 EXPANSION AND BALL JOINT INSULATION COVERS

A. Furnish and install removable and reusable insulation covers.

B. Insulation and jacketing material shall be as required for service temperatures.

C. Covers shall have hook and loop fasteners and draw cords.

PART 3 - EXECUTION

3.1 GENERAL

A. The installation of all insulation shall be made by experienced craftsmen in a neat, workmanlike manner and shall be in accordance with the manufacturer's published recommendations for service intended, as interpreted by the Architect.

B. All adhesives used in conjunction with insulation shall be compatible with the insulation and vapor barrier used and be vermin-proof and mildew resistant.

3.2 APPLICATION

A. Install materials in accordance with manufacturer's instructions.

B. Ductwork:

1. External Duct Insulation: All external duct shall be installed without sagging or loose fitting sections. Outer jacket shall be sealed with mastic to form a continuous vapor barrier. Install as recommended by the insulation manufacturer.
2. Flexible fiberglass insulation shall be wrapped around ducts and secured with outward clinching staples. Ducts 24" wide and larger shall have the insulation additionally secured with stick clips on 18" centers or with 4" wide bands of adhesive applied on 18" centers. Insulation shall be lapped a minimum of 4" and all seams and penetrations shall be sealed with an approved mastic reinforced with 3" glass mesh reinforcement. Where insulation terminates, all raw glass shall be sealed to duct.

C. Insulation shall be the full specified thickness, continuous through walls, floors, ceilings, etc. Reducing thickness or cutting back of insulation to pass obstructions or through sleeves will not be permitted.

D. Valve and fitting insulation shall be built up to the thickness of the adjacent pipe insulation or may be factory prefabricated units at the Contractor's option.

E. Any painting of pipe insulation shall be accomplished under the Painting Section. After finish painting, any insulation showing splits or other signs of poor workmanship shall be replaced.

F. No part of any system shall be insulated until all required tests have been completed.

G. All insulation shall be installed so that it does not interfere with the functions of thermometer wells, gage connections and/or cocks, unions, access panels, hand holes, manholes, sight glasses, etc., or obscure serial numbers or other nameplate data.

H. Insulation shall be extended to include stiff leg supports as required to prevent sweating.

I. Complete vapor barriers to prevent sweating shall be installed on all cold systems and equipment. If a single tape adhesive system or staples are used for closure of the longitudinal lap, a vapor barrier mastic must be used to ensure a vaporproof closure. All

edges and abutments shall be sealed, waterproof and vaporproof. Supplier of jacket materials shall certify that the material proposed is approved for use in return air plenums, where applicable.

J. Where necessary, the application of insulation shall be arranged to accommodate movement of piping due to thermal expansion and/or contraction.

K. Exterior Piping: All pipe and fittings specified herein to be insulated when installed exposed to weather, shall be insulated, and wrapped with an 0.016" smooth or corrugated aluminum jacket with proper closure system positioned to shed water to make a waterproof assembly. Fittings shall be insulated with molded insulation fittings or pipe insulation carved and mitered to fit properly. Insulation shall be butted together and adhered in place with contact cement. Where possible tubing shall be slipped on without slitting. Where insulation terminates, it shall be neatly beveled and finished. No portion of this insulation shall be concealed prior to approval by the Architect.

L. Below Grade Piping: All pipe and fittings specified herein to be insulated, when installed below grade shall be insulated and spirally wrapped with open mesh glass tape embedded in asphaltic mastic and then completely covered with waterproof asphaltic mastic so as to make a waterproof assembly. Fittings shall be insulated with molded insulation fittings or pipe insulation carved and mitered to fit properly. Insulation shall be butted together and adhered in place with contact cement. Where possible tubing shall be slipped on without slitting. Where insulation terminates, it shall be neatly beveled and finished. No portion of this insulation shall be concealed before the Architect has checked and approved same.

M. Piping supports shall pass completely around the exterior of the finished insulation. Rigid blocks of insulation material shall be provided at all support points. In addition, sheet metal saddles shall be provided at support points in accordance with the following table:

Pipe Size	Gauge Metal	Saddle Length
Up to 2-1/2"	18	6"
3" - 5"	16	10"
6" - 8"	16	14"
10" and Over	16	18"

N. Saddles shall cover the bottom of the insulation, and saddle edges shall be hemmed or suitably covered to prevent damage to the insulation material.

O. The vapor barrier and finish shall be continuous at all support points.

P. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-19, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
   a. Fan discharges.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts where air velocities are higher than 2000 fpm or where indicated.
9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
   a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

Q. Lined exterior ductwork shall be treated with an acid etch bath and two coats of UV resistant paint. Color shall be approved by Architect.

R. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

END OF SECTION

SECTION 23 0993
SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 SCOPE

A. Control sequence is hereby defined to mean the manner in which, and methods by which, the controls function. The requirements for each type of operation are specified in this section.
B. The operating equipment, devices, and system components required for the control system are specified by Section 230923 of these specifications.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.
B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

PART 2 - SEQUENCE OF OPERATION FOR THE MECHANICAL SYSTEM

2.1 VARIABLE REFRIGERANT VOLUME HEAT PUMP

A. The DDC system shall monitor and control each split system fan coil.
B. A wired controller for each fan coil shall have the following features:
    - Operation
        - Start/Stop
        - Operation Mode
        - Temperature Setting
        - 60˚F-90˚F Set Point Range
        - Fan Speed
    - Status
        - Status
        - Malfunction Flashing
        - Malfunction Content
        - Filter Sign
        - Operation Mode
        - Temperature Setting
        - Permit/Prohibit Selection
        - Fan Speed
    - Scheduling
        - ON/OFF Timer
    - Control Management
        - Field Setting Mode
        - Group Setting
        - Auto Re-Start

C. The space served by the split system is controlled in Occupied and Unoccupied modes as follows:
   1. In Occupied mode the fan is on, the DDC controller stages the cooling and heating in sequence to maintain the room temperature set point.
   2. In Unoccupied mode the split system is controlled using the Unoccupied space temperature set point. The unit fan is off when the space temperature is between the heating and cooling Unoccupied set points. The controller may reset to the Occupied mode for a predetermined time period upon a signal from the control system or manually at the room sensor.

2.2 EXHAUST FANS

A. Exhaust fans serving one room shall start and stop with a motion sensor interlocked with the light fixtures The fans shall run for 5 minutes (adjustable) after the lights turn off.

2.3 BUNKER GEAR VENTILATION FAN

A. The fan shall have an HOA switch mounted 48" A.F.F. at a location as directed by the architect and owner.
B. In the auto position, the fan shall operate in the following manner. On sensing a RH level above setpoint, the fan shall be energized. The fan shall be de-energized upon sensing an RH level below setpoint.

2.4 APPARATUS BAY EXHAUST FAN

A. The Apparatus bay fan shall have a timer switch adjustable from 1 to 60 minutes mounted 48" AFF at a location as directed by the architect and owner to allow for manual operation. The switch shall open an outside air in-take damper. An end switch on the damper shall start the Apparatus Bay Exhaust Fan. The outside air in-take damper shall be closed and the exhaust fan shall stop when the time is complete.
B. CO sensor and NO2 sensor shall be located at height as recommended by manufacturer in location indicated on plans or by architect.
C. In the auto position, the fan shall operate in the following manner. On sensing a CO or NO2 level above setpoint (adjustable), the relay shall open an outside air in-take damper. An end switch on the damper shall start the Apparatus Bay Exhaust Fan. On the sensing an acceptable CO or NO2 level, the outside air in-take damper shall be closed and the exhaust fan shall stop. The fans shall also be interlocked to the garage door motors. When the garage door motors are powered down to a closed position the fans shall be energized and run for 15 minutes (adjustable).

2.4 ELECTRICAL INTERLOCKS

A. Provide electrical interlocks as listed herein, in other sections of these specifications and as noted in the equipment schedules.
B. Electrical interlocks shall be made by means of auxiliary contacts on motor starters or shall be accomplished with separate relays unless indicated otherwise. No motor power lead shall be utilized in an interlock circuit, unless indicated otherwise. Each separate control power lead serving a starter shall be provided with a disconnecting switch suitably identified and housed, which may be a toggle switch or other suitable disconnecting device, or proper capacity and number of poles.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. The Contractor shall furnish and install items as shown on the drawings or as necessary to provide a complete working system in accordance with the intent of the drawings and specifications, including all valves as indicated or as necessary to completely control the entire piping system. The piping drawings are diagrammatic and indicate the general routing, locations, and connections. The piping may require be offsetting, lowering or rising as needed to avoid interferences or as directed at the site. This does not relieve the Contractor from responsibility for the proper installation of piping systems.

B. Work Included:

1. Refrigerant piping and accessories.

C. Submittals: Provide submittals as required in Section 23 0500, “Common Work Results for HVAC”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements to comply with ANSI, ASTM, ASME, CISPI, IAPMO, PDI, and AWWA and all other applicable standards.

D. Copies of each welder's certification documents shall be furnished to the Architect prior to them performing work.

E. All pipes, valves, and fittings shall be manufactured in the United States. Mill Test reports and manufacturer’s certifications shall be submitted to the Engineer on all such materials used.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Refrigerant Piping:

1. Seamless ACR copper tubing, Type L, hard drawn with wrought or bronze solder joint fittings.

2.2 VALVES, COCKS AND SPECIALTIES

A. Materials: Bronze, ductile iron, or cast iron per local codes with screwed, Vic-Press 304™, grooved, or flanged ends for steel pipe and Permalynx push-to-connect, grooved, or solder ends for copper pipe.

B. Valve locations:

1. Provide a valve on inlet and outlet of each piece of equipment.
2. Provide valves to isolate individual or a group of equipment on branch runouts from piping mains. This is in addition to valves at each fixture and equipment.
3. Provide valves as indicated and where required to adequately service parts of systems and equipment.

C. Refrigerant Valves:

1. Globe and Angle Valves: Forged brass or bronze alloy with packed stem and seal cap.
2. Check Valves: Spring-loaded, forged brass or bronze alloy body with solder connections.
3. Relief Valves: Forged brass bodies with nonferrous corrosion resistant internal working parts. Valves shall be in accordance with ANSI B9.1.
4. Solenoid Valves: Two-position, direct acting or pilot operated type, UL listed, with manual opening stem and constructed for servicing without removal from lines. Valves shall have coil housing, stainless steel enclosing tube, replaceable seat, and proper inlet and outlet connections for the type of pipe containing the valve.

D. Dielectric Unions or Waterway Fittings:

1. Provide dielectric unions or waterway fittings at all piping connections (except to valves) between dissimilar metals, Watts No. 3000 series, Victaulic Style 47, or engineer approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. All work shall be performed by workmen skilled in the trade required for the work. All materials and equipment shall be installed in accordance with the approved recommendations of the manufacturer and the best practices of the trade in conformance with the contract documents.

B. Refer to Section 23 0529, “Hangers and Supports for HVAC Piping and Equipment” for general piping support requirements.

3.2 INSTALLATION

A. Refer to Section 23 0500, “Common Work Results for HVAC” for general installation requirements.

B. Underground Pipe: The bottom of the trench shall be shaped to give substantially uniform support to the lower third of each pipe. Each pipe shall be laid true to line and grade and in such manner as to form a concentric joint with adjoining pipe and to prevent sudden offsets to flow line. As work progresses, the interior of the pipe shall be cleaned of dirt and foreign materials of any kind. Where cleaning after laying is difficult, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after joining has been completed. Trenches shall be kept free from water until pipe joining is complete and pipe shall not be laid when condition of trench or weather is unsuitable for such work. At all times when work is not in progress, all open ends of pipe fittings shall be securely closed to the satisfaction of the Architect so that no water, earth or other substance will enter pipe or fittings.

C. Erection of Pipe above Grade: Piping shall be properly supported and adequate provisions shall be made for flashing, expansion, contraction, slope and anchorage. All piping shall be cut accurately for fabrication to measurements established at the construction site. Pipe shall be worked into place without springing and/or forcing, properly clearing all structural elements, finished rooms, windows, doors, and other openings and equipment. Cutting or other weakening of the building structure to facilitate installation will not be permitted.

D. All changes in direction shall be made with fittings, except that bending of pipe will be permitted providing a hydraulic pipe bender is used. Bent pipe showing kinks, wrinkles or other malformation will not be acceptable.

E. Copper tubing shall be joined by the following method:
   1. The tubing shall be reamed to remove all burrs from the inside diameter of the pipe.
   2. The tubing and fitting shall be sanded or brushed to a uniform bright finish.
   3. Apply a paste flux to both tubing and fitting.
   4. Fully heat the joined parts and apply solder to the joint.
   5. Completely fill the joint with solder, wiping any excess solder outside the joint while still liquid.

F. Mitering of pipe to form elbows or notching straight runs to form tees will not be permitted unless shop fabricated by a certified welder. Weldolet or Threadolet fittings may be used in lieu of welding tees.

G. Provide sleeves around all pipes passing through walls, floors, ceiling, partitions, structural members or other building parts.

H. Refrigerant Piping:
   1. Refrigerant piping shall not be run concealed in walls or partitions nor underground or under the floor except as indicated on the drawings. Where pipe passes through building structure, pipe joints shall not be concealed, but shall be located where they may be readily inspected.
   2. Refrigerant piping shall be brazed with silver solder complying with AWS A5.0 or "Sil-Fos". The inside of tubing and fittings shall be free of flux. The parts to be joined shall be cleaned bright with emery cloth and shall be heated to a temperature slightly greater than the solder flow point, and shall be kept hot until the solder has penetrated the full depth of the fitting. Joints shall be cooled in the air after which flame marks and traces of flux shall be removed. During the brazing operation, the tubing shall be protected from forming an oxide film on the inside by slowly flowing dry nitrogen to expel the air. Installation of the piping shall comply with ANSI B31.5.
   3. Refrigerant lines shall be installed so that the gas velocity in the evaporator suction line is sufficient to move the oil along with the gas to the compressor. Where equipment location requires a vertical riser, the line size shall be as shown and installed to provide sufficient gas velocity or a double riser shall be installed as shown on the drawings. The larger riser shall have a trap, of minimum volume, formed by the use of 90 degree and 45 degree ells. The small riser shall be located with its inlet just upstream of the trap and shall connect to the top of the horizontal line. Valves shall not be installed in risers except as shown on the drawings.
   4. Refrigerant driers, sight glass liquid and moisture indicators, and strainers shall be provided in refrigerant piping for remote installations when not furnished by the manufacturer as part of the equipment. Driers shall be installed in liquid line with service valves and a valved bypass line which are the same size as liquid line in which the drier is installed. Driers of 50 cubic inches and larger shall be installed with the cover and the full cartridge being easily removable.
   5. Sight glass liquid and moisture indicators shall be installed in the liquid line downstream of the drier. Connections shall be the same size as the liquid line in which it is installed, up to 7/8"; 1-1/8" and larger shall have a 1/4" indicator installed in the "By-pass" position.

6. Strainers shall be located close to equipment they are to protect. A strainer shall be provided in the refrigerant liquid supply to expansion valves. Strainers shall be installed with screen down and in direction of flow as indicated on the strainer's body.
7. Refrigerant Charging Valve: A valved refrigerant charging connection shall be provided for each field piped refrigeration system when not provided as part of the condensing unit. The valve shall be located on the reducing outlet of a full size tee in the liquid line, upstream from the refrigerant drier and sight glass moisture indicator. Valves shall be of the seal cap type, 1/2" min. port size.
8. Solenoid valves shall be installed in horizontal lines with the stem vertical and with flow in direction indicated on the valve. If not incorporated as an integral part of the valve, strainers shall be provided upstream of each solenoid valve, with a service valve upstream of the solenoid valve. The solenoid valve shall be disassembled according to the manufacturers' recommendations when brazing the valve into the piping.

END OF SECTION

SECTION 23 3113
METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision and services necessary for or incidental to the installation of all air distribution items as indicated on the drawings and as specified.

B. Work Included:
   1. Ductwork.
   2. Access Doors.

C. Submittals: Provide submittals as required in Section 23 0500, ”Common Work Results for HVAC”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials and methods meet or exceed minimum requirements as specified.

PART 2 - PRODUCTS

2.1 SHEET METAL DUCTWORK

A. Ducts shall be constructed of new-galvanized steel sheets and erected in a first class manner, straight and smooth, with joints neatly finished, anchored securely to the building and free from vibration.

B. All ducts penetrating fire walls shall be minimum 26 gauge galvanized steel regardless of SMACNA Standards.

C. All elbows shall be curved elbows with a centerline radius equal to 1-1/2 times the width of the duct. Air turns consisting of curved metal vanes, arranged to permit the air to follow abrupt turns without appreciable turbulence shall be installed in square elbows, only where approved by the engineer. Air turns shall be the manufacturer's standard products, and shall be quiet and free from vibration.

D. All ductwork shall be fabricated in accordance with the Sheet Metal and Air Conditioning Contractor's National Association, Inc. (SMACNA) "HVAC Duct Construction Standards, Metal and Flexible, Second Edition, 1998". The duct static pressure rating for this duct shall be two times the external static pressure of the system fan. The requirements for the seal class corresponding to the above static pressure shall be met.

E. Longitudinal joints shall be Pittsburgh lock or Acme grooved seam. Side panels greater than 10 inches in depth shall be cross-broken for added stiffness.

F. Transverse joints shall be Ductmate, TDC or types fabricated according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" Figure 1-4, "Transverse (Girth) Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

G. Splitter damper shall have end bearings and consist of a blade constructed of 20 gauge-galvanized steel securely riveted or welded to a square operating rod. The length of the splitter blade shall be 1-1/2 times the width of the split in the main duct, but in no case less than 12". Multi-blade adjustable pickup shall be as manufactured by Titus Model AG-45 or approved equal with operator adjustable from the duct exterior.

H. Volume dampers shall have end bearings and be multi-blade type with opposed acting blades linked together and controlled by a single operator. Multi-blade dampers shall be not less than No. 16 gauge galvanized steel mounted to plenum or ductwork per SMACNA requirements.

I. Regulators shall be stamped galvanized steel, lever type with locking screw mounted on face of ductwork or concealed type with adjustable cover plate as manufactured by Young Regulator Model No. 315 with 2-1/4" diameter cover plate or approved equal.

J. Damper quadrants, volume dampers and other duct flow control quadrants shall be as manufactured by Young Regulator or approved equal.

K. Cable shall consist of Bowden cable 0.054” stainless steel control wire encapsulated with 1/16” flexible galvanized spiral wire sheath. Control kit shall consist of 270-896 bracket with a 7/8” diameter cold rolled steel zinc plated threaded cap suitable for painting, and 14 gauge steel rack and pinion gear drive converting rotary motion to push-pull motion. Control shafts shall be D-style flatted ¼” diameter with 265 degree rotation providing graduations for positive locking and control, and 1-1/2” linear travel capability. Control kit shall be manually operated using Young Regulator Model 030-12 wrench. Provide a wrench for each cable control system installed. Control kit shall be Young Regulator Model 270-896P with tamper proof screws or prior approval equal.

2.2 FLEXIBLE DUCTWORK

A. Core material shall be a PVC Coated Fiberglass reinforced fabric supported by helically wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesive.

B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least 2-1/2 times the working pressure.

C. The duct shall be rated for a velocity of at least 5500 feet per minute.

D. Suitable for operating temperatures of at least 250 degrees F.

E. Factory insulate the flexible duct with flexible fiberglass insulation. The R value shall be at least 5.0 at a mean temperature of 75 degrees F. (R4.2 not acceptable)

F. Cover the insulation with a reinforced aluminum pigmented vapor barrier jacket having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, procedure A.

G. The ductwork shall be UL 181 listed, Class 1 Air Duct and comply with NFPA 90A and NFPA 90B.

H. Duct shall be secured with metal bands.

I. Duct shall be Flexmaster Type 8M or pre-approved equal

2.3 ACCESS DOORS

A. Provide access doors equal to Nailor-Hart Ind., Inc. Series 0800.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All ductwork shall be installed as recommended by SMACNA and as shown or indicated on the drawings. Coordinate ductwork with all other trades and elements of the building construction.

B. All ductwork accessories shall be provided as specified or shown or indicated on the drawings, install as recommended by SMACNA and the manufacturer.

C. Ductwork shall be installed in a neat, workmanlike manner with ducts generally parallel to structure and tops of ducts as high as possible against building construction. Provide offsets as necessary to avoid obstructions, piping, or structural members.

D. Flexible ductwork shall be installed and supported as recommended by SMACNA and the manufacturer.

E. At each major branch from a primary rectangular or square trunk duct, and where shown on the drawings, install a splitter damper or multi-blade adjustable air pickup.

F. Each individual air supply duct tap shall be equipped with a volume control device for the manual adjustment of airflow in each tap. Face bars, blanks, and equalizing grids shall not be used to regulate airflow.

G. Volume dampers shall be installed within ducts or plenums where shown on the drawings and on all supply/return/exhaust taps for balancing of system.

H. Round or oval ductwork shall be fastened together with a minimum of three sheet metal screws equally spaced around the perimeter of the duct and taped with an approved duct sealing tape. Ductwork shall be furnished complete with all factory fabricated starting collars, Y shaped branch takeoffs, adjustable elbows, etc.

I. Where ducts are in mechanical rooms or unfinished areas, or where dampers occur above lift out ceilings, regulators shall be stamped galvanized steel, lever type with locking screw mounted on face of ductwork. For all other areas, where damper adjustments cannot be accessed through the ceiling, regulators shall be the concealed type with adjustable cover plate.

J. For all detention areas and other areas where damper adjustments cannot be accessed through the ceiling, Bowden cable controls shall be used. Damper controller and cable shall be concealed above the ceiling. Control kit shall be imbedded in the ceiling flush with the finished surface. Control kit shall not be located within detention living areas, exact location shall be approved by the architect prior to installation.

K. On the inlet and outlet of each piece of air moving equipment, unless noted otherwise, install a flexible connection made with sufficient slack to render it flexible.

L. Where air intakes and/or discharges are indicated on the drawings and no air device is indicated, install 1/4" bird screens over each duct opening set in galvanized steel frames and securely attach to the openings.

M. Furnish and install 26 gauge galvanized steel counter flashings for all ducts penetrating roofs and for all roof mounted equipment unless directed otherwise by the Architect.

N. Provide concentric taps on all connections from the main duct to branch ducts.

O. Provide stamped steel access doors at each fire damper, fire and smoke damper, where control devices occur within ductwork, and as indicated on the drawings. Access doors shall be fully insulated where duct is lined internally. Provide with mounting flange, double thickness door with cam latch, gasket and retaining wire. No tools shall be required to open the access door.

P. The minimum size of each access door shall be sufficient to provide adequate access for the intended purpose of installation.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of all necessary air handling items as shown on the drawings and/or specified.

B. Work Included:
   1. Fans

C. Submittals: Provide submittals as required in Section 23 0500, “Common Work Results for HVAC”.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents. When requested, provide Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not operate fans for any purpose until ductwork is clean, filters in place, bearings lubricated, and fan has been test run under observation.

1.5 EXTRA MATERIALS

A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag sets to identify fan.

PART 2 - PRODUCTS

2.1 GENERAL

A. Performance Ratings: Conform to AMCA 210 and bear the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. Fabrication: Conform to AMCA 99.

D. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

E. Provide accessories as scheduled.

F. Fans shall be manufactured by Greenheck, Cook, Penn Barry or pre-approved equal.

2.2 ROOF EXHAUST FANS - DOWNBLAST

A. Roof exhaust fans shall be centrifugal direct drive type. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced. The fan housing and shroud shall be constructed of heavy gauge aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Wheels shall be statically and dynamically balanced.

B. The fan housing and shroud shall be constructed of heavy gauge aluminum with a rigid internal support structure. The fan shroud shall have a rolled bead for added strength. Motors shall be mounted out of the airstream on vibration isolators. Fresh air for motor cooling shall be drawn into the motor compartment from an area free of discharge contaminants. Motors shall be readily accessible for maintenance. A disconnect switch shall be factory installed and wired from the motor compartment for ease of electrical wiring.

C. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

D. Each fan shall bear a permanently affixed manufacturer's nameplate containing the model number and individual serial number for future identification.

2.3 CABINET FAN

A. Duct mounted supply, exhaust or return fans shall be of the centrifugal, belt driven in-line type. The fan housing shall be of the rectangular design constructed of heavy gauge galvanized steel and shall include rectangular duct mounting collars.

B. A hinged or removable panel shall be provided in the fan cabinet of sufficient size to permit access for service to all of the fan's internal components without dismantling the cabinet.

C. The fan wheel shall be of the galvanized steel, forward curved, centrifugal type. Wheels shall be dynamically and statically balanced.

D. Motors shall be of the heavy duty type with permanently sealed ball bearings. The wheel shaft shall be ground and polished steel mounted in permanently sealed pillow block bearings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the machined cast iron type, keyed and securely attached to the wheel and motor shafts. The motor pulleys shall be adjustable for final system balancing.

E. All fans shall bear the AMCA Certified Ratings Seal for air performance.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units with manufacturer recommended clearances for service and maintenance.

C. Install fans with resilient mountings and flexible electrical leads.

D. Install flexible connections between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

E. Provide backdraft dampers on discharge of exhaust fans where indicated.

F. Label units according to requirements specified in Division 23 Section "Identification for HVAC Piping and Equipment".

G. Refer to Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

END OF SECTION

SECTION 23 3713
DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of all necessary air handling items as shown on the drawings and/or specified.

B. Work Included:
   1. Air Supply and Grilles.
   2. Louvers.

C. Submittals: Provide submittals as required in Section 23 0500, ”Common Work Results for HVAC”.
   1. Submit schedule of outlets and inlets indicating type, size, location, application, and noise level.
   2. Review requirements of outlets and inlets as to size, finish, and type of mounting prior to submitting product data and schedules of outlets and inlets.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents. When requested, provide Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

C. Test and rate performance of air outlets and inlets in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.

D. Test and rate performance of louvers in accordance with AMCA 500.

PART 2 - PRODUCTS

2.1 AIR SUPPLIES AND RETURNS:

A. Grilles, registers and ceiling outlets shall be as scheduled on the Drawings. Devices shall be the type, size, capacity, performance, and by the manufacturer scheduled or approved equal. If a manufacturer other than the one scheduled is used, the sizes shown on the Drawings shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made. Selections shall meet the manufacturer's own published data for the above performance criteria. The throw shall be such that the velocity at the end of the throw in the five foot occupancy zone will be not more than 50 FPM nor less than 25 FPM. Noise levels shall not exceed those published in the ASHRAE Guide for the type of space being served (NC level).

B. Locations of outlets on Drawings are approximate and shall be coordinated with other trades to make symmetrical patterns and shall be governed by the established pattern of the lighting fixtures or architectural reflected ceiling plan. Where called for on the schedules, the grilles, registers and ceiling outlets shall be provided with deflecting devices and manual damper. These shall be the standard product of the manufacturer, subject to review by the Architect, and equal to brand scheduled.

C. .All adjustable pattern lay-in type-ceiling diffusers shall be adjustable without the use of tools.

D. All ceiling mounted devices shall be provided with frames compatible with the ceiling type. Coordinate air device frame type and color with architectural reflected ceiling plans and Architect's room finish schedule to match adjacent surface in which the device will be installed.

E. Acceptable Manufacturers:
   1. Kees
   2. Price
   3. Titus
   4. MetalAire

2.2 LOUVERS

A. Aluminum fixed blade louvers shall be extruded aluminum, stationary stormproof type, with a drain gutter in each blade. Blades and frames shall be minimum 0.1 inch thick with reinforcing bosses and shall be of 6063-T5 alloy. Head, jamb and sill shall be of one piece structural member of 6063-T5 Alloy with integral calking slot and retaining bead. Supports and blades shall have provision for expansion and contraction. All fastenings shall be stainless steel or aluminum. Louvers shall be free of all scratches, blemishes and defects. Sizes shall be as shown on the Drawings. Louvers shall have a minimum free area of 50% and a maximum pressure drop of 0.02 inches of water at 500 feet per minute air velocity.

B. Structural supports shall be provided and designed by the louver manufacturer to carry a windload of not less than thirty-five pounds per square foot (35 psi).

C. Provide louvers with removable bird screens, consisting of aluminum frame with mitered corners and 0.063 inch (1.6 mm) diameter 1/2 inch aluminum wire mesh. Bird screen shall be attached to interior of louver with sheet metal screws or clips.

D. Provide backdraft dampers adjacent to each wall louver in all cases with exception of louvers that provide the introduction of combustion air .

E. Louver finish shall be as directed by Architect.

F. Acceptable Manufacturers:
   1. Greenheck
   2. Ruskin
   3. Pottorff

2.3 LOW SILHOUTTE ROOF HOODS

A. Gravity roof ventilators shall be constructed of heavy gauge aluminum. Hoods shall be constructed of precision formed, arched panels with interlocking seams. Bases shall be constructed so that the curb cap is 8 in. larger that the throat size. Hood support members shall be constructed of galvanized steel and fastened so that the hood can be either removed completely from the base or hinged open.

B. Birdscreens constructed of 0.5 in. galvanized steel mesh shall be mounted horizontally across the intake area of the hood. Intake units with throat widths through 42 in. shall ship assembled when throat lengths do not exceed 84 in.

C. Mount unit on minimum 12 inch high curb base with insulation between duct and curb. Bases shall be furnished for intake applications to restrict entry of moisture and for all applications where rain and snow may accumulate on the roof deck.

D. Make hood outlet area minimum of twice throat area.

E. Acceptable Manufactures
   1. Greenheck
   2. Kees, Inc.
   3. Penn Venilation

2.4 LOUVER PENTHOUSE

A. The louvered penthouse shall feature a stormproof aluminum louver with mitered corners. The penthouse shall have a removable cover lined with fiberglass to prevent condensation.

B. The louvered penthouse shall have the options as scheduled which include birdscreens, dampers, roof curbs and special finishes. Birdscreens shall be constructed of 0.5 in. galvanized steel mesh. Louvers shall be mounted 4 in. from the roof opening.

C. Each unit shall be factory assembled from four side sections and one cover. Covers for larger units may be two or more pieces if recommended by the manufacturer. A factory assembled side consists of the curb cap, vertical supports, and the quantity of louvers required for the specified height. The sides are joined at the four corners by sheet metal screws in each louver. These fasteners are countersunk so as not to disturb the architectural appearance of the mitered corner. The cover is securely fastened to the unit by stainless steel sheet metal screws.

D. The interior vertical edge of the curb cap forms the throat and weathershield. Each corner is also shielded to prevent leakage. Additional vertical supports are provided for added strength whenever a side section exceeds 44 in. in throat length.

E. Mount unit on minimum 12 inch high curb base with insulation between duct and curb. Bases shall be furnished for intake applications to restrict entry of moisture and for all applications where rain and snow may accumulate on the roof deck.

F. Acceptable Manufactures
   1. Greenheck
   2. Kees, Inc.
   3. Penn Venilation

2.5 GOOSENECKS

A. Fabricate in accordance with SMACNA Low Pressure Duct Construction Standards of minimum 18 gage galvanized steel.

B. Mount on minimum 14 inch high curb base where size exceeds 9 x 9 inch

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install items in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, regardless of whether dampers are specified as part of the diffuser, or grille and register assembly.

E. Paint ductwork visible behind air outlets and inlets matte black. If grille is not ducted then provide insulated boot with side opening in order to prevent visible systems above the ceiling.

F. Grille security level shall match or exceed the type of ceiling/wall the grille is installed in.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 23 8149
VARIABLE REFRIGERANT AIR CONDITIONING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to the Work in this Section.

1.2 SUMMARY

A. Provide all equipment, materials, labor, supervision and services necessary for or incidental to the installation of a complete and operating refrigeration and air handling system as indicated on the drawings and as specified.

B. Contractor Qualifications:

1. The contractor installing this system shall have installed a minimum of five (5) VRF systems of similar size or larger within the past three (3) years.
2. A list of projects, year project was installed and commissioned, installed tonnage (indoor units and outdoor unit), and reference contact information shall be provided in the submittal.

C. Work included:

1. Variable Refrigerant Flow System

D. Submittals: Provide submittals as required in Section 23 0500, ”Common Work Results for HVAC”. IN ADDITION, and specifically related to the VRF portion of work:

1. Manufacturer software shall be used to produce piping tree and shall be submitted (1) before ordering material, (2) confirmed/revised for actual field dimensions before welding/pressure testing, and (3) submitted after pressure testing to document final pipe sizes and lengths and shall be included as “As-Builts”.
2. After the final piping connection is made, confirm that all valves within the refrigerant circuit are open, date/time stamped photos of the pressure gauge(s) at both the beginning and ending of a successful pressure test OR documented observation by a 3rd party along with ambient temperatures for the same period shall be submitted. The subcontractor shall be knowledgeable of the Ideal Gas Law to be able to judge a successful pressure test while ambient conditions vary. A pressure test shall be considered “successful” when it has held the manufacturer’s stated PSI for the manufacturer’s stated minimum duration. Additionally, the refrigerant circuit shall remain under pressure until the refrigerant circuit is prepared for start-up at which point it shall be measured and documented to match that of the original successful pressure test. **THE INSTALLER IS CHARGED WITH NOTIFYING THE JOBSITE OF SAFETY REQUIREMENTS CONCERNING WORKING NEAR PIPING UNDER PRESSURE.**
3. BEFORE START-UP, the installer shall purge the refrigerant circuit of nitrogen and pull a vacuum on the entire open circuit down to 500 microns and shall hold for 1 hour. It shall be measured and documented by Factory Authorized Commissioning Agent.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are

required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that the equipment meets or exceeds minimum requirements as specified.

D. All equipment shall have a minimum EER in accordance with ASHRAE 90.1 unless specified otherwise.

E. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

F. All wiring shall be in accordance with the National Electric Code (NEC).

G. The system will be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

H. All VRF equipment shall be stored protected from weather, extreme temperature, etc. as suggested by the manufacturer. All VRF equipment shall be moved, lifted, etc. as suggested by the manufacturer.

PART 2 - PRODUCTS

2.1 VARIABLE CAPACITY, VARIABLE REFRIGERANT VOLUME/VARIABLE REFRIGERANT FLOW SERIES

A. System Description: The variable capacity, heat recovery air conditioning system shall be a Variable Refrigerant Flow Series (simultaneous heat/cool model) split system or equal as approved by Architect. The system shall consist of multiple evaporators using PID control. The unit shall be a, direct expansion (DX), variable speed driven compressor (minimum of two compressors and two fans per module) multi zone heat pump split system, using R410A refrigerant. The outdoor unit may connect an indoor evaporator capacity up to 130% to that of the outdoor condensing unit capacity or as otherwise allowed or limited by manufacturer. Every indoor unit shall be independently capable of operating in either heating or cooling mode regardless of the mode of other indoor units. The system shall be capable of changing mode of individual indoor units (cooling to heating or heating to cooling) within a maximum time of 5 minutes to ensure indoor temperature can be properly maintained.

B. The outdoor unit shall be interconnected to indoor units and shall range in capacity from 12,000 Btu/h to 48,000 Btu/h in accordance with the Manufacturer’s engineering data book detailing each available indoor unit. The indoor units shall be connected to the outdoor utilizing the Manufacturer’s specified piping joints and headers.

2.2 CONDENSING (OUTDOOR) UNIT

A. General: The outdoor unit is designed specifically for use with VRF series components.

1. The outdoor unit shall be used with VRF components of the same manufacturer consisting of the outdoor unit, high efficiency heat recovery units, indoor units, factory designed and supplied fittings, and controls.
2. System components shall be of the same manufacturer or as recommended by the manufacturer of the VRF equipment.
3. Unit control boards shall perform all functions required to effectively and efficiently operate the VRF system and communicate in a daisy chain configuration from outdoor unit to heat recovery and indoor units via RS485.
4. The outdoor unit shall be completely factory assembled, piped and wired. Dual and triple frame outdoor units will be field piped with factory

designed and supplied accessories to manifold them together into a single refrigerant circuit.

5. Each outdoor unit shall be run tested at the factory.
6. The sum of connected nominal capacity of all indoor air handlers shall range from 50% to 130% of outdoor unit nominal capacity to ensure the VRF system will have sufficient capacity to handle the building space loads at peak design.
7. Outdoor unit shall have a tested sound rating no higher than 58 dB(A) per outdoor unit frame tested per KSA0701. The outdoor unit frame shall include three quiet/nighttime operation settings of 47, 44, and 41 dBA.
8. All refrigerant lines from the outdoor unit to the heat recovery unit and from the heat recovery unit to the indoor units shall be field insulated.
9. The outdoor unit shall have an accumulator.
10. The outdoor unit shall have a high pressure safety switch
11. The outdoor unit shall have over-current protection.
12. The outdoor unit shall use a brazed plate subcooling heat exchanger.
13. The outdoor unit shall have the ability to operate with an elevation difference of up to 300 feet above or below the indoor units.
14. The outdoor unit shall allow up to a total equivalent refrigerant piping length of 3,000 feet.
15. The maximum length from outdoor unit to indoor unit shall be up to 600 feet without traps.
16. The outdoor unit shall be capable of operating in heating only mode down to -4°F and up to 61°F ambient wet bulb without additional low ambient controls.
17. The outdoor unit shall be capable of operating in cooling only mode down to 21°F and up to 110°F ambient dry bulb.
18. The outdoor unit shall be capable of operating in simultaneous heating and cooling mode down to 14°F and up to 86°F ambient dry bulb.
19. The outdoor unit shall have an oil separator for each compressor and controls to ensure sufficient oil supply is maintained for the compressor.
20. Shall use R410A refrigerant.
21. Each outdoor unit frame shall have a removable inspection panel no greater than 6 inches tall or 12 inches wide to allow access to service tool connection, DIP switches, auto addressing and error codes.

B. Unit Cabinet:

1. Shall be constructed with galvanized steel, bonderized and be finished with powder coat baked enamel paint.

C. Fan:

1. All outdoor unit frames shall be furnished with two direct drive, variable speed propeller type fans.
2. All fan motors shall have inherent protection, have permanently lubricated bearings, and be variable speed with a maximum speed up to 950 rpm.
3. All fans shall be provided with a raised guard to limit contact with moving parts.
4. The outdoor unit shall have vertical discharge airflow.

D. Condenser Coil:

1. The outdoor coil shall be of nonferrous construction with louvered fins on copper tubing.
2. The coil fins shall have a factory applied corrosion resistant material with hydrophilic coating.
3. The coil shall be protected with an integral metal guard.
4. Refrigerant flow from the outdoor unit shall be controlled by means of a digitally controlled inverter driven scroll compressor.

E. Compressor:
   1. All 208/230V 3 phase outdoor unit frames shall be equipped with one hermetic digitally controlled inverter driven scroll compressor and one hermetic constant speed scroll compressor.
   2. A crankcase heater shall be factory mounted on all compressors.
   3. The outdoor unit compressor shall have an inverter to modulate capacity. The frequency of the inverter compressor shall be completely variable from 25 to 105Hz.
   4. The compressor shall be equipped with an internal thermal overload.
   5. The compressor shall be mounted to avoid the transmission of vibration.

F. Electrical:
   1. The outdoor unit electrical power shall be 208/230V, 60 Hz, 3 phase.
   2. The outdoor unit shall be capable of operation within voltage limits of +/- 10% rated voltage.
   3. The outdoor unit shall be controlled by integral microprocessors.
   4. The control circuit between the indoor units, heat recovery box and the outdoor unit shall be 24VDC completed using a 2-conductor, stranded, and shielded cable for the RS485 daisy chain communication.

G. Units shall be as manufactured by Daikin, Mitsubishi, LG, Samsung, Trane, Carrier or pre-approved equal.

2.3 REFRIGERANT PIPING:

A. Refrigerant piping shall comply with all other project specifications.

B. Refrigerant piping shall be installed in a neat and orderly fashion taking care to avoid to unnecessary traps, bends, elbows, kinks, etc.

C. Refrigerant piping shall be supported and secured at proper intervals as determined by code and saddled or otherwise installed such that the pipe insulation is protected from compressing by more than 50% of its original dimension.

D. The installer is responsible for strictly following the manufacturer's guidelines for piping; including the angle and direction of manufacturer supplied fittings, observing rules pertaining to bends before and after manufacturer supplied fittings, and keeping within line length limitations between all equipment and manufacturer supplied fittings.

E. Pipe sizes, lengths, and elbows shall match exactly to the final piping tree produced by the manufacturer's software and provided in approved submittals and shop drawings.

F. Piping shall be brazed while maintaining at least 2 psi of flowing nitrogen.

G. Flaring shall be performed as stated by the manufacturer and produced with tools recommended by the manufacturer.

H. Pipe insulation shall be a thickness as determined by the applicable code, but never less than the manufacturer's stated guideline and shall be installed completely and without air gaps. Insulation shall be installed on ALL refrigerant pipes. Insulation on pipes exposed to weather shall be protected against UV radiation by coating or jacketing.

2.4 HEAT RECOVERY UNITS FOR SIMULTANEOUS HEATING AND COOLING

A. General: Heat recovery units shall be designed for use with VRF equipment of the same manufacturer.
   1. The selector boxes shall be factory assembled, wired, and piped.
   2. The sum of connected capacity of all indoor air handlers shall range from 50% to 130% of rated capacity.
   3. The branch controllers must be run tested at the factory.
   4. The selector boxes must be mounted indoors.
   5. When simultaneously heating and cooling, the units in heating mode shall energize their sub cooling solenoid valve.
   6. The piping shall be installed in accordance with the manufacture's design guidelines and not exceed lights and capacities indicated in design guidelines.

B. Unit Cabinet:
   1. These units shall have a galvanized steel plate casing.
   2. Each cabinet shall house multiple refrigeration control valves and a liquid gas separator.
   3. The cabinet shall contain a tube in tube heat exchanger.
   4. The unit shall have sound absorption thermal insulation material made of flame and heat resistant foamed polyethylene.

C. Refrigerant Valves:
   1. The unit shall be furnished with a 3-way refrigerant valve to control the direction of refrigerant flow.
   2. Electronic expansion valves shall be used to control the variable refrigerant flow.
   3. The refrigerant connections must be of the flare type.
   4. Full port isolation valves shall be field supplied and installed on the outlet of the Controller to each indoor unit or as suggested by manufacturer for ease of service to the heat recovery unit without evacuating the entire system refrigerant charge. Valve Shall be designed for use with R410A

D. Drainage:
   1. The unit shall not require drainage.

E. Electrical:
   1. The unit electrical power shall be 208/230 volts, 1 phase, 60 hertz.
   2. The unit shall be capable of operation within the limits of 187 volts to 255 volts.
   3. The minimum circuit amps (MCA) shall be 0.2 and the maximum fuse amps (MFA) shall be 15.
   4. The control voltage between the indoor and outdoor unit shall be 16VDC non-shielded 2 conductor cable.

2.5 4-WAY CEILING CASSETTE INDOOR UNIT

A. General: Four-way ceiling cassette indoor units shall recess into the ceiling and mount flush. Shall be designed for use with R410a refrigerant. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same manufacturer. The indoor unit shall communicate with the outdoor unit via RS485 daisy chain communication. Shall be rigidly constructed using a decaweb base plate

B. Indoor Unit:
   1. The indoor unit shall be factory assembled, wired and run tested.
   2. The indoor unit shall be factory wired and piped with its own electronic expansion device, control circuit board, fan and motor.
   3. The indoor unit shall have
      a. self-diagnostic function
      b. auto restart function

4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:
1. The four-way ceiling cassette cabinet shall be designed to recess into the ceiling.
2. The cabinet panel shall have provisions for a field installed, pressurized and filtered outside air intake.
3. Branch ducting shall be allowed from cabinet following manufacturer recommendations.

D. Return Air Grille:
1. Four-way grille shall be fixed to bottom of the cabinet and allow two, three or four-way air flow.
2. Grille vane angles shall be individually adjustable from the wired remote controller to customize the airflow pattern for the conditioned space.
3. The indoor unit vanes shall have 6 fixed positions
4. The indoor unit vanes shall be capable of automatically swinging the vanes up and down for uniform air distribution. Vanes shall also be capable of being stopped at any position during swing operation.
5. The indoor unit shall have a setting in the heating or cooling mode that shall cycle the vanes up and down to evenly heat or cool the space.
6. Four-way ceiling cassette grille shall have integral sensor to read wireless handheld remote controller as standard from the factory.

E. Fan:
1. The indoor fan shall be an assembly with one turbo fan direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced.
3. Motor shall have permanently lubricated bearings.
4. In cooling mode, the indoor fan shall have the following settings; Super Low, Low, Med, High, Power Cool, and Auto.
5. In heating mode, the indoor fan shall have the following settings; Super Low, Low, Med, High, and Auto.
6. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
7. The indoor unit shall have DIP switches that can be set to provide optimum airflow based on ceiling height.
8.

F. Filter:
1. Return air shall be filtered with a removable, washable filter.
2. Shall be furnished as standard with a factory installed plasma filter with no additional external power supply required.

G. Coil:
1. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. The coils shall be pressure tested at the factory.
4. A condensate drain pan shall be factory installed below the coil.
5. All refrigerant lines to the indoor units shall be field insulated.

H. Condensate Pump:
1. The unit shall include a factory installed condensate pump that will be able to raise drain water a minimum of 20 inches above the ceiling cassette face.

I. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 Hz.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

J. Control:

1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.

2.6 HIGH STATIC CEILING-CONCEALED DUCTED INDOOR UNIT

A. General: High static ceiling concealed duct indoor unit shall mount fully concealed within the ceiling. Shall be designed for use with R410a refrigerant. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same manufacturer. The indoor unit shall communicate with the outdoor unit via RS485 daisy chain communication. Field installed ductwork shall not exceed the external static pressure limitation of the high static ducted indoor unit.

B. Indoor Unit:
1. The indoor unit shall be factory assembled, wired and run tested.
2. The indoor unit shall be factory wired and piped with its own electronic expansion device, control circuit board, fan and motor.
3. The indoor unit shall have
   a. self-diagnostic function
   b. auto restart function
4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:
1. The cabinet shall be ceiling-concealed and ducted.

D. Fan:
1. The indoor unit fan shall be no more than one assembly with two Sirocco fans direct driven by a single motor.
2. The indoor fan shall be statically and dynamically balanced.
3. Motor shall have permanently lubricated bearings.
4. In cooling mode, the indoor fan shall have the following settings; Low, Med, and High.
5. In heating mode, the indoor fan shall have the following settings; Low, Med, and High.

E. Filter:
1. Return air shall be filtered with a factory supplied removable, washable filter.

F. Coil:
1. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
2. The tubing shall have inner grooves for high efficiency heat exchange.
3. The coils shall be pressure tested at the factory.
4. A condensate drain pan shall be factory installed below the coil.
5. All refrigerant lines to the indoor units shall be field insulated.

G. Condensate Pump:
1. The unit shall include a factory installed condensate pump that will be able to raise drain water a minimum of 20 inches above the ceiling cassette face.

H. Electrical:
1. The unit electrical power shall be 208/230 volts, 1-phase, 60 Hz.
2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

I. Control:
1. The unit shall have controls provided by the manufacturer to perform input functions necessary to operate the system.
2. Unit shall use controls provided by the manufacturer to perform all functions

necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.

2.7 WALL-MOUNTED INDOOR UNIT

A. General: Wall-mounted indoor units shall protrude from the wall no more than 7 inches. Shall be designed for use with R410a refrigerant. Shall be installed with heat pump or simultaneous heating and cooling heat pump VRF systems of the same manufacturer. The indoor unit shall communicate with the outdoor unit via RS485 daisy chain communication

B. Indoor Unit:
   1. The indoor unit shall be factory assembled, wired and run tested.
   2. The indoor unit shall be factory wired and piped with its own electronic expansion device, control circuit board, fan and motor.
   3. The indoor unit shall have
      a. self-diagnostic function
      b. auto restart function
   4. Indoor unit refrigerant circuit shall be filled with a dry nitrogen gas charge from the factory.

C. Unit Cabinet:
   1. The unit casing shall have a pearl white finish.
   2. Multi directional refrigerant piping up to four (4) directions shall be standard.
   3. Multi directional drain piping up to two (2) directions shall be standard.
   4. The indoor unit shall attach to a separate back plate that secures the unit to the wall.
   5. Indoor unit casing shall have integral sensor to read wireless handheld remote controller as standard from the factory.

D. Fan:
   1. The indoor fan shall be an assembly with one cross flow fan direct driven by a single motor.
   2. The indoor fan shall be statically and dynamically balanced.
   3. Motor shall have permanently lubricated bearings.
   4. In cooling mode, the indoor fan shall have the following settings; Low, Med, High, Power Cool, and Auto.
   5. In heating mode, the indoor fan shall have the following settings; Low, Med, High, and Auto.
   6. The fan shall have a selectable Auto fan setting that will adjust the fan speed based on the difference between controller set-point and space temperature.
   7. A manually adjustable guide vane shall be factory installed allowing the ability to control the direction of airflow from side to side for units 15MBh and below.
   8. A motorized sweeping guide vane shall be factory installed allowing the ability to control the direction of airflow from side to side for units 18MBh and above.
   9. A motorized air sweep louver shall provide an automatic change in airflow by directing the air up and down to provide uniform air distribution.

E. Coil:
   1. The indoor unit coil shall be nonferrous with louvered fins on copper tubing for maximum efficiency.
   2. The tubing shall have inner grooves for high efficiency heat exchange.
   3. The coils shall be pressure tested at the factory.
   4. A condensate drain pan shall be factory installed below the coil.
   5. All refrigerant lines to the indoor units shall be field insulated.

F. Electrical:
   1. The unit electrical power shall be 208/230 volts, 1-phase, 60 Hz.
   2. The indoor unit shall be capable of operation within voltage limits of +/-10% rated voltage.

G. Control:
1. The unit shall have controls provided by manufacturer to perform input functions necessary to operate the system.
2. Unit shall use controls provided by the manufacturer to perform all functions necessary to operate the system effectively and efficiently and communicate with the outdoor unit over an RS485 daisy chain.

H. Accessories:
1. A condensate pump.

2.8 CONTROLS

A. General
1. Communication daisy chain wiring to be 2-conductor, twisted pair shielded cable throughout the system

B. Central Control – AG-150 Touch Screen Controller with power supply
1. Can address up to 50 indoor units
2. Available Functions
3. On/Off Control
4. Mode Selection
5. Lock Mode
6. Setpoint Control
7. Adjustable temperature range control
8. Fan Speed Control
9. Custom Scheduling
10. Indoor Unit Operational Status
11. Device setpoint data display status
12. Provide with system battery backup and USB Port for software updates
13. Ability to turn on/off third party devices through the application of a digital expansion kit (accessory) ie. lighting, ventilation units, exhaust fans
14. Emergency Stop
15. 9 inch touchscreen LCD with stylus pen and storage slot
16. Ability to customize names in a zone/group/unit
17. Provide malfunction notification via email
18. Shall have ability to be web-based and can schedule, change setpoints and turn equipment on/off via the web
19. User and Administrator Levels with password protection

C. Individual Indoor Unit Controller - Wired Wall Mounted Controller (Thermostat)
1. Each indoor unit will be provided with its own wired wall mounted controller.
2. Provided with 30’ of 2-conductor, twisted pair shielded cable with controller (thermostat)
3. Available Functions
   a. On/Off Control
   b. Temperature Setting
   c. Fan Speed
   d. Air Flow Direction
   e. Child Lock
   f. Mode Selection
   g. Ability to allow up to 2 controllers per indoor unit
   h. Ability to control a group of 16 indoor units with 1 controller
   i. Auto addressable
   j. Provide with Display, Fan Speed Selection switch, and Temp Setting Adjust

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment shall be installed as shown or indicated on the drawings and as recommended by the manufacturer.

B. Variable Refrigerant Flow (VRF) systems use a high pressure refrigerant and have unique installation procedures and requirements. It is imperative that the installation of these systems meet factory specifications in order for the systems to meet the expected performance and efficiency.

1. Factory training for installing technicians. – Prior to installation, the installing mechanical contractor must provide written proof that all installing technicians have received adequate training by the equipment manufacturer or approved alternate. Approved contractors who are awarded this project may contact the manufacturer to arrange training prior to installation for any unqualified technicians. The mechanical contractor's installation price shall be inclusive of the manufacturer's installation requirements including the cost of training, specialty tools, and cost charged by the manufacturer for technical assistance.
2. Job installation support and certification. – In order to assure properly installed system components and approved installation procedures, the specified manufacturer or approved alternate must provide installation technical support for the installing contractor via telephone and the internet, and job site supervision. Upon completion of installation and prior to factory startup, a factory authorized commissioning agent must inspect the installation of each system to verify proper installation. Upon verification of proper installation, the manufacturer is to submit a letter of certification approving the installation of their respective systems.
3. Factory Startup and Warranty Approval – Upon verification and written receipt of proper installation, a factory authorized commissioning agent is to perform a factory approved initial startup of all system components. Such that the requirements to receive the maximum manufacturer's warranty are met and confirmed with the manufacturer.

3.2 PRODUCT SUPPORT

A. Maintain a fully staffed service office within 400 miles (1 day drive) of the job site. Fully staffed means a full time secretary, complete service library, at least 2 factory trained service technicians and the factory recommended spare parts inventory.

B. Provide a 24 hour/7 day technical support phone number to factory service office. Support shall be for all components including controls, mechanical components, system operation and alarm codes, etc.

C. The Manufacturer or local representative shall maintain a complete parts inventory for all systems that will allow for 24 hour receipt of any necessary part.

D. Provide owner/operator and service training both on line and at designated training centers.

3.3 OPERATING RANGE

A. The operating range for the VRF system in cooling will be 23°F DB ~ 115°F DB. The operating range in heating will be 0°F DB – 64°F DB / -5°F WB – 60°F WB.

3.4 EQUIPMENT START-UP

A. The VRF system must be installed by a factory trained contractor/dealer.

B. Equipment start up shall be by factory trained personnel. The startup shall be attended by the controls contractor and Test and Balance contractor.

3.5 PIPING SCHEMATIC

A. The VRF piping system must be installed by a factory trained contractor/dealer based on the manufacturers sizing recommendations.

B. Provide full port refrigerant valves at each indoor unit and outdoor unit.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 260200
SITE ELECTRICAL

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 01 Specification sections, apply to work covered by this Section.

B. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of all site electrical work.

B. The site electrical work shall include, but not be limited to, the furnishing and installation of necessary materials and making arrangements for:

1. The connection of electrical, telephone utilities and data.
2. Underground conduit.
3. Power to exterior lighting.
4. Connections to generator.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 for products specified under PART 2 - PRODUCTS.

1.4 REFERENCE STANDARDS

A. National Electrical Code (NEC), Article 300

B. Service installation standards of the serving utility company(s).

PART 2 – PRODUCTS

2.1 ELECTRICAL SERVICE

A. Coordination: The location of the electrical service entrance shall be coordinated with the electric utility company and with all other trades. Provide materials and equipment required to connect the electrical service.

B. Materials: Provide materials in accordance with other Sections of these Specifications.

2.2 TELEPHONE SERVICE

A. Coordination: The location of the telephone service entrance shall be coordinated with the telephone utility company and with all other trades. Provide materials and equipment required to connect the telephone service.

B. Materials: Provide materials in accordance with other Sections of these Specifications.

C. Coordination: The location of all underground electrical work such as service for parking lot lighting, site lighting, site security, etc. shall be coordinated with all other trades.

D. Materials: Provide materials in accordance with other Sections of these Specifications.

PART 3 – EXECUTION

3.1 GENERAL

A. Underground installation of more than one conduit shall be in a “ductbank” arrangement. All conduits shall be laid so joints are staggered, 18” minimum depth.

B. Pour a red colored concrete envelope minimum 3" thick over electrical and telephone service conduits.

C. Perform excavation, shoring, backfilling and concrete work in connection with electrical work in accordance with other Divisions of the Specifications.

D. Provide underground warning tape 6" to 12" below finished surface along entire length of underground conduit or ductbank. Interface installation of underground warning tape with backfilling.

3.2 UTILITIES

A. The locations, elevations and voltage of electrical lines and the location of the telephone lines included within the area of this work are indicated on the Drawings or in the Specifications in accordance with information received by the Owner.

B. The Contractor shall examine the site and shall verify, to his own satisfaction, the location and elevation of all utilities, and shall adequately inform himself as to their relation to the work.

C. The work associated with existing utility lines to be abandoned or removed, shown within the scope of this project, will be arranged by the Owner with the respective utility.

D. Existing utility lines not indicated but encountered during construction shall be protected, relocated or capped as directed by the Owner's Representative. All precautions shall be exercised to prevent damage to existing lines not shown, but should work become necessary, it must be authorized prior to execution except in an emergency situation.

E. Before beginning excavations of any nature whatsoever, the Contractor shall make an attempt to locate all underground utilities of every nature occurring within the bounds of the area to be excavated. The Contractor shall then proceed with caution in his excavation work so that no utility shall be damaged with a resultant loss of service.

F. Should damage result to any utility through the Contractor's negligence or failure to comply with the above directive, he shall be liable for such damage and for all expense incurred in the expeditious repair or replacement of such damaged utilities.

G. Repair of damaged utilities shall be to a condition equal to or better than the adjacent undamaged portion of such utility and to the complete satisfaction of the Owner.

END OF SECTION

SECTION 260500
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 DESCRIPTION

A. General Requirements for Electrical Work are intended to be complementary to General Requirements of Construction Contract.

B. Work Included: Provide complete electrical systems where shown on Drawings, as specified herein, and as needed for complete and proper installation including, but not necessarily limited to following summary of Work.

1. Interior and exterior lighting
2. Emergency exit and egress lighting
3. Fire detection and alarm system.
4. Telephone conduit system
5. Lighting and Distribution panelboards
6. Lightning protection system
7. Power feeds to mechanical equipment
8. Surge protective devices
9. Power to mechanical, plumbing and fire protection equipment:
   Provide conduit, wire, disconnect switch, overcurrent and short circuit protection for all equipment, whether shown on the drawings or not, including, motorized dampers, smoke dampers, electric heat trace, power for energy management system, water softening equipment, water treatment systems, air dryers, electric flush valves, electric trap primers, and other miscellaneous equipment.
10. Packaged Generator Sets (supplied by Owner, installed by Contractor)
11. Automatic Transfer Switch (supplied by Owner, installed by Contractor)
12. Telephone Service Entrance and cable TV entrance
13. Electrical Service Entrance
14. Other items and services required to complete electrical systems

1.2 QUALITY ASSURANCE AND APPLICABLE STANDARDS

A. Use adequate numbers of skilled workers thoroughly trained and experienced in necessary crafts and completely familiar with specified requirements and methods needed for proper performance of Work of this Division. Ensure that there is a minimum of one journeyman electrician, on job site whenever Division 16 Work is being performed.

B. Without additional cost, provide labor and materials as required to complete Work of this Division in accordance with requirements of Governmental Agencies having jurisdiction, regardless of whether materials and associated labor are called for elsewhere in these Contract Documents.

C. Codes: Electrical and fire alarm Work shall conform to requirements and recommendations of the following codes:

1. 2011 National Electrical Code
2. 2008 International Energy Code
3. 2008 International Fire Code
4. 2005 International Building Code
5. Local amendments to the above codes

D. Standards: Specifications and Standards of following organizations are by reference made part of these Specifications. Electrical Work, unless otherwise indicated, shall comply with requirements and recommendations wherever applicable:

1. Association of Edison Illuminating Companies (AEIC)
2. American National Standards Institute (ANSI)
3. American Society of Mechanical Engineers (ASME)
4. American Society for Testing and Materials (ASTM)
5. Certified Ballast Manufacturers (CBM)

6. Electrical Testing Laboratories (ETL)
7. Institute of Electrical and Electronic Engineers (IEEE)
8. Insulated Power Cable Engineers Association (IPCEA)
9. National Bureau of Standards (NBS)
10. National Electrical Contractors Association (NECA)
11. National Electrical Manufacturer's Association (NEMA)
12. National Fire Protection Association (NFPA)
13. Radio-Television Manufacturer's Association (RTMA)
14. Reflector Luminaire Manufacturers (RLM)
15. Underwriters' Laboratories, Inc. (UL)

1.3 REQUIREMENTS OF REGULATORY AGENCIES

A. Requirements and recommendations of latest editions of Occupational Safety and Health Act (OSHA), Texas Accessibility Standards (TAS) and Americans with Disabilities Act (ADA), are by reference made part of these Specifications. Work shall comply with requirements and recommendations wherever applicable.

1.4 RELATED WORK SPECIFIED ELSEWHERE

A. Other Sections of Divisions 21, 22, 23 and 26.

B. Other Divisions of Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.5 DEFINITIONS

A. Terms *furnish*, *install*, and *provide* are used interchangeably and shall mean to furnish and install, complete and ready for intended use.

1.6 SUBMITTALS

A. Comply with pertinent provisions of Division 01.

B. Engineer will not review electronically transmitted submittals. Submit hard copies of the submittal to the prime consultant (i.e. architect) in order to process and track the submittals properly in accordance with division 1, 15 and 16 submittal requirements.

C. Submittals required of materials and equipment include following:

1. Materials list of items proposed to be provided under Division 16.
2. Manufacturer's specifications and other data needed to prove compliance with specified requirements. Term "Compliance" is understood to mean that Contractor certifies that submitted equipment meets or exceeds Contract Document requirements. Items that do not clearly meet this definition should be identified and explained as required in following paragraph.
3. Identify difference between specified item and proposed item. Explain with enough detail so that it can easily be determined that item complies with functional intent. List disadvantages or advantages of proposed item versus specified item. Submit technical data sheets and/or pictures and diagrams to support and clarify. Organize in clear and concise format. Substitutions shall be approved in writing by Engineer. Engineer’s decision shall be final.
4. Allow minimum of 10 working days for review of each submittal and re-submittal.
5. Items of equipment that are not accepted in writing as approved equal shall be replaced or revised to comply with Contract Documents at Contractor's expense.
6. The manufacturers recommended installation procedures shall become basis for accepting or rejecting actual installation procedures used on Work.
7. Shop drawings shall consist of detailed drawings with dimensions, schedules, weights, capacities, installation details and pertinent information needed to describe the material or equipment.

C. Submittals required of materials and equipment under this Division include following listed items not supplied by Owner. These submittal requirements are intended to be complimentary to requirements that may be listed in individual sections. In event of conflict, more stringent requirement shall apply.

1. Conductors and Cables:
   a.) Submit product data for each specified product.

b.) Submit tabular list of wire and wiring systems that will be increased in capacity or size to comply with Section 260519 and/or similar requirements shown on Drawings. List shall include size shown on Drawings, proposed increase to comply with Section 260519, and proposed installed length.

2. Raceways and Boxes:
   a.) Submit product data for surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
   b.) Submit Shop Drawings including layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.
3. Wiring Devices:
   a.) Submit product data for each specified product.
   b.) Submit operation and maintenance data for wiring devices, for inclusion in "Operating and Maintenance Manual" specified in this Section.
   c.) Provide in bid, materials and labor associated for the addition of 8 additional 120v circuits for new receptacles and 8 new telephone/data receptacle locations to be added during construction.
4. Grounding:
   a.) Submit product data for grounding rods, connectors and connection materials, and grounding fittings.
5. Dry-Type Transformers:
   a.) Submit product data for each product specified, including dimensioned plans, sections, and elevations. Show minimum clearances and installed features and devices.
   b.) Submit wiring diagrams of products differentiating between manufacturer-installed and field-installed wiring.
   c.) Submit product certificates signed by manufacturers certifying that their products comply with specified requirements.
   d.) Submit operation and maintenance data for materials and products to include in "Operating and Maintenance Manual" specified in this Section.
6. Panelboards:
   a.) Submit product data for each type panelboard, accessory item, and component specified.
   b.) Submit Shop Drawings prepared by the manufacturers including dimensioned plans, sections, and elevations. Show tabulations of installed devices, major features, and voltage rating. Include enclosure type with details for types other than NEMA Type 1; bus configuration and current ratings; short-circuit current rating of panelboard; and features, characteristics, ratings, and factory settings of individual protective devices and auxiliary components.
   c.) Submit typewritten panelboard schedules to the Engineer for approval prior to installation.
   d.) Submit maintenance data for panelboard components, for inclusion in Operating and Maintenance Manual specified in this Section. Include instructions for testing circuit breakers.
7. Disconnect Switches:
   a.) Submit product Data for disconnect switches and specified accessories.
8. Automatic Transfer Switches: (supplied by Owner, installed by Contractor)
   a.) Submit Shop Drawings or product data for each transfer switch, including dimensioned plans, sections, and elevations showing minimum clearances; conductor entry provisions; gutter space; installed features and devices; and materials lists.
   b.) Submit wiring diagrams, elementary or schematic, differentiating between manufacturer-installed and field-installed wiring.
   c.) Submit operation and maintenance data for each type of product, for

inclusion in Operating and Maintenance Manual specified in this section. Include features and operating sequences, both automatic and manual. List factory settings of relays and provide relay setting and calibration instructions.

d.) Submit manufacturer's certificate of compliance to referenced standards and tested short-circuit closing and withstand ratings applicable to protective devices and current ratings.

9. Engine-Generator Set: (supplied by Owner, installed by Contractor)
   a.) Submit exhaust emissions.
   b.) Submit wiring diagrams for system, showing power and control connections and distinguishing between factory-installed and field-installed wiring.
   c.) Submit product data for products specified in this Section. Include data on features, components, ratings, and performance. Include a dimensioned outline plan and elevation drawings of the engine generator set, the weatherproof enclosure, sub-base fuel tank and other system components.
   d.) Submit maintenance data for system and components for inclusion in Operating and Maintenance Manual specified in this Section.
   e.) Submit detailed operating instructions, covering operation under both normal and emergency conditions and sound test reports.
   f.) Submit certification of torsional vibration compatibility: Conform to NFPA 110.
   g.) Submit factory test reports for units to be shipped for this Project showing evidence of compliance with specified requirements.
10. Motor Controllers:
   a.) Submit product data for specified products. Include dimensions, ratings, and data on features and components.
   b.) Submit maintenance data for products for inclusion in Operating and Maintenance Manual specified in this Section.
11. Lighting:
   a.) Submit product data describing fixtures, lamps, ballasts, and emergency lighting units. Arrange product data for fixtures in order of fixture designation. Include data on features and accessories.
   b.) Submit outline drawings indicating dimensions and principal features of fixtures, including color.
   c.) Submit electrical ratings and photometric data including certified results of laboratory tests for fixtures and lamps.
   d.) Submit battery and charger data for emergency lighting units.
   e.) Submit Shop Drawings detailing nonstandard fixtures and indicating dimensions, weights, and methods of field assembly, components, features and accessories.
   f.) Submit wiring diagrams detailing wiring for control system showing both factory-installed and field-installed wiring for each specific system which differentiates between factory-installed and field-installed wiring.
   g.) Submit maintenance data for fixtures to include in operation and maintenance manual specified in this Section.
   h.) Submit lamp data for each fixture.
12. Fire Alarm System:
   a.) Submit product data for each type of system component specified including dimensioned plans and elevations showing installed features and devices. Include list of materials and nationally recognized testing laboratory-listing data. Submit to Engineer after being reviewed and approved by local authority having jurisdiction.

b.) Submit wiring diagrams from manufacturer differentiating clearly between factory- and field-installed wiring. Include diagrams for equipment and for system with terminals and interconnections identified. Make diagrams specific to this Project and distinguish between field and factory wiring.

c.) Submit device address list.

d.) Submit system operation description covering this specific Project, including method of operation and supervision of each type of circuit and sequence of operations for manually and automatically initiated system inputs and outputs. Manufacturer's standard descriptions for generic systems are unacceptable.

e.) Submit operating instructions for mounting at fire alarm control panel.

f.) Submit battery hours of operation calculations for loss of normal power operation.

g.) Submit maintenance data for fire alarm systems to include in operation and maintenance manual specified in this Section. Include data for each type of product, including features and operating sequences, both automatic and manual. Include recommendations for spare parts to be stocked at site. Provide names, addresses, and telephone numbers of service organizations that carry stock of repair parts for system to be furnished.

h.) Submit design drawings approved by local authority having jurisdiction.

13. Lightning protection system:

a.) Submit product data for each type of system component specified including dimensioned plans and elevations showing installed features and devices. Include list of materials and nationally recognized testing laboratory-listing data. Submit to Engineer after being reviewed and approved by local authority having jurisdiction.

1.7 SUBSTITUTIONS

A. The Contract Documents list manufacturers' names and catalog numbers followed by phrase "or equal" are to establish a standard of quality and utility for the specified items and to provide a dimensional reference to the scaled drawings.

B. Submittals for "equal" items shall include the following data, which is not necessarily required for specified items, which list the manufacturer and catalog number:

1. Performance characteristics.
2. Materials.
3. Finish.
4. Certification of conformance with specified codes and standards.
5. Manufacturer's specifications and other data needed to prove compliance with specified requirements. Term "compliance" is understood to mean that the submitted equipment will meet or exceed the Contract Document requirements. Items that do not clearly meet this definition shall be identified and explained as required in following Paragraph.
6. Identify all differences between the specified item and proposed item. Explain all differences with sufficient detail to permit the Engineer to easily determine that the substituted item complies with the functional intent. List disadvantages and advantages of proposed item versus specified item. Submit technical data sheets and/or pictures and diagrams to support and clarify. Organize in clear and concise format. Engineer shall approve substitutions in writing. Engineer’s decision shall be final.

C. Submittals of "equal" components or systems may be rejected if:

1. Material or equipment would necessitate alteration of mechanical, electrical, architectural, or structural design.
2. Dimensions vary from specified material or equipment so that accessibility or clearances are impaired or Work of other trades is adversely affected.

D. Proposed substitutions for materials or equipment must be submitted 10 days prior to final bid date for consideration as approved equals. Otherwise, substitutions will not be permitted. Only the prime bidders shall be permitted make proposals for substitutions.

E. No substitution shall be made unless authorized in writing by Engineer. Should substitution be accepted, and should substitute material prove defective or otherwise unsatisfactory for service intended, and within guarantee period, replace this material or equipment with material or equipment specified, to satisfaction of Engineer and at no cost to Owner.

1.8 ORDINANCES, PERMITS, METERS, UTILITIES AND ROYALTIES

A. Purchase all necessary permits and licenses necessary for completion of the Work. Pay all lawful fees required and necessary pursuant in obtaining said permits and licenses. Required certificates of approvals and inspections by local governing and regulating authorities.

B. Pay all fees required for connection of utility power and telephone services required for the Work.

C. Pay royalty payments or fees required for use of patented equipment or systems. Defend lawsuits or claims for infringement of patent rights and hold Owner and/or Engineer harmless from loss as result of said suits or claims.

1.9 COMPATIBILITY OF EQUIPMENT

A. Assume full responsibility for satisfactory operation of component parts of electrical systems. Assure compatibility of equipment and performance of integrated systems in accordance with requirements of the Construction Documents. Notify the Engineer before submitting a bid should Specifications or Drawings make acceptance of responsibility impossible, prohibitive, or restrictive. The bid shall be accompanied by a written statement listing any objections or exceptions to the applicable specification section and/or drawing.

1.10 UTILITIES AND TEMPORARY POWER

A. Verify location and capacity of all existing utility services before starting Work. The locations and sizes of electrical lines are shown in accordance with data secured from Owner's survey. The data shown is offered as estimating guide without guarantee of accuracy.

B. Pay all utility charges for temporary power. Provide temporary lighting and power required. Install in accordance with OSHA requirements and as described in General Requirements Division 1.

1.11 FLASHINGS, SLEEVES, AND INSERTS

A. Furnish and install flashings where conduits pass through outside walls. Flashings shall be properly formed to fit around conduit and shall be caulked, with 790 Silicone Building Sealant by Dow Corning Corporation, so as to make watertight seal between conduit and building.

B. Unless otherwise specified, install sleeves for each conduit where it may pass through interior walls or floors. Galvanized 22-gage sheet iron sleeves shall be used. Finish flush with each finished wall surface. In pipe chases, the sleeve shall extend 1-1/2 inches above floor slab and shall be watertight.

C. Raceways that pass through concrete beams or walls and masonry exterior walls shall be provided with galvanized wrought iron pipe sleeves, unless shown otherwise on drawings. Inside diameter of these sleeves shall be at least 1/2 inch greater than outside diameters of service pipes. After pipes are installed in these sleeves, fill annular space between pipes and sleeves with 790 Silicone Building Sealant by Dow Corning Corporation. Completed installation shall be watertight.

D. Roof penetrations shall be provided with counter flashings arranged to provide weatherproof installation.

E. Penetrations through walls, floors and ceilings shall be done in manner to maintain integrity of fire rating of respective wall, floor, or ceiling.

F. Reference Division 7 for additional sealant requirements. Where conflicts occur with the specified requirements, the more stringent shall apply.

1.12 CUTTING AND PATCHING

A. Perform cutting and patching in strict accordance with provisions of these Specifications and following:

1. Coordinate Work to minimize cutting and patching.

2. Use adequate number of skilled workers who are thoroughly trained and experienced in necessary crafts and who are completely familiar with specified requirements and methods needed for proper performance of Work.

B. Request for Engineer's consent:
1. Prior to cutting which affects structural safety, submit a written request to Engineer for permission to proceed with cutting.
2. When conditions of Work or schedule require a change of materials or methods for cutting and patching, notify Engineer and secure written permission to proceed with the work.

C. Perform cutting and demolition using methods that will prevent damage to other portions of Work.

D. Perform fitting and adjusting to provide a finished installation complying with specified tolerances and finishes.

1.13 SURFACE CONDITIONS

A. Examine areas and conditions under which Work of this Division will be performed. Work required to correct conditions detrimental to timely and proper completion of Work shall be included as part of Work of this Division. Do not proceed until unsatisfactory conditions are corrected.

1.14 CONSTRUCTION REQUIREMENTS

A. Drawings show arrangements of Work. Rearrangement of spaces and equipment will be considered when Project conditions make this necessary and/or materials or equipment can be installed to better advantage. Prior to proceeding with Work, coordinate with various trades to prepare and submit five (5) copies of Drawings of proposed arrangement for Engineer's review. Allow minimum of 10 working days for review.

B. Installation or rearrangement of equipment and space for Contractor's convenience or to accommodate material or equipment substitutions will be considered. Assume responsibility for rearrangement of equipment and space and have Engineer review change before proceeding with Work. Request for changes shall be accompanied by Shop Drawings of affected equipment and space. Identify proposed monetary credits or other benefits. Allow minimum of 10 working days for review.

C. Properly locate and size all required pipe sleeves and slots, holes, or openings in structure.

1.15 PREPARATION AND COORDINATION

A. Coordinate the work in strict accordance with the Contract Documents as follows:
1. Where lighting fixtures and other electrical items are shown in conflict with locations of structural members and mechanical or other equipment, provide required supports and wiring to clear encroachment.
2. Install power and control wiring for installation of equipment furnished under Division 15. Furnish disconnect switches and other equipment as required for proper operation of equipment unless equipment is specified to be factory mounted.

B. Information on the Drawings and in these Specifications is as accurate as could be secured, but absolute accuracy is not guaranteed. The drawings are diagrammatic, and the exact locations, distances, levels, and other conditions shall be governed by actual construction. The drawings and specifications shall be for guidance.

C. Where receptacle locations are not dimensioned on either the Architectural or Engineering Drawings, the j-box may be located on the nearest stud. When receptacles are dimensioned on the Drawings, provide a cross brace and mount the receptacle as dimensioned.

D. Field-verify measurements. No extra compensation will be allowed because of differences between Work shown on Drawings and actual site measurements.

E. Branch circuit wiring and arrangement of home runs have been designed for maximum economy consistent with adequate sizing and other considerations. Increase size of wiring and wiring systems to accommodate more stringent requirements listed in these Specifications or on Drawings. Install wiring with circuits arranged as shown on Drawings. Deviations shall be approved in advance by Engineer.

1.16 PROJECT RECORD DOCUMENTS

A. Provide Project record documents associated with Work in accordance with provisions of these Specifications. Refer to Division 01 for additional requirements.

B. Throughout progress of the Work, maintain accurate record of all changes in Contract Documents (Drawings and Specifications). Changes shall include Addendums issued during bidding and location of electrical service lines, receptacles, and outside utilities.

C. Delegate responsibility for maintenance of record documents to one person on Contractor's staff.

D. Accuracy of Records:
   1. Thoroughly coordinate changes within record documents, making adequate and proper entries on each page of Specifications and each sheet of Drawings and other documents where required to show change properly. Match symbology and format of base documents.
   2. Accuracy of records shall be such that future searches for items shown in Contract Documents may rely reasonably on information obtained from approved Project record documents.

E. Maintain a job set of record documents protected from deterioration and from loss and damage until completion of Work. Transfer all recorded data to final Project record documents.

F. Making Entries on Drawings
   1. Using erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
   2. Date entries.
   3. Call attention to entry by "cloud" drawn around area or areas affected.
   4. In event of overlapping changes, use different colors for overlapping changes.
   5. Make entries within 24 hours after receipt of information that changes have occurred.
   6. Maintain base drawing format and use the same symbols.
   7. Convert field mark-ups to finished CADD record drawings when required in this Section.

G. Conversion of Schematic Layouts
   1. In some cases on Drawings, arrangements of conduits, circuits, and similar items, are shown schematically and are not intended to portray precise physical layout. Determine final physical arrangement, subject to Engineer’s approval. The design of future modifications of facility may require accurate information as to final physical layout of items that are shown only schematically on Drawings. Show by dimension accurate to within one inch, centerline of each run of sleeves and conduit below grade, in walls, or in concrete slab, etc. Surface mounted device indicates exact location:
      a.) Clearly identify item by accurate note (e.g., "Rigid Conduit”).
      b.) Show, by symbol or note, vertical location of item “under slab,” “in ceiling plenum,” “exposed,” etc.
      c.) Make identification sufficiently descriptive that it may be related reliably to Specifications.

H. Final Project Record Documents
   1. The purpose of the final Project Record Documents is to provide factual information regarding all aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
   2. Provide CADD electronic files in dwg Format using AutoCAD Release 2002 software. Upon written request, completion of a release form, and payment of the Engineer’s standard fee of $200 plus applicable sales tax for a set-up charge and $50 per drawing plus applicable sales tax for copies of such files, Engineer will provide AutoCAD Release 2002 electronic files of base Contract Drawings in dwg

format on compact discs. Engineer will also provide a list of drawing layers and names that shall be maintained.

3. Provide completed record drawings on CD and one mylar film reproducible of each drawing.
4. Refer to Division 01 for additional requirements.

1.17 OPERATION AND MAINTENANCE DATA

A. Submit two copies of preliminary draft of proposed manual or manuals to Engineer for review and comments. Allow minimum of 10 working days for review.

B. Submit approved manual to Engineer prior to indoctrination of operation and maintenance personnel.

C. Where instruction manuals are required for submittal, they shall be prepared in accordance with the following:

Format:

Size: 8-1/2-inch by 11-inch

Paper: White bond, at least 20 pound weight

Text: Neatly written or printed

Drawings: 11 inches in height preferable; bind in with text; foldout acceptable; larger drawings acceptable but fold to fit within Manual and provide drawing pocket inside rear cover or bind in with text.

Flysheets: Separate each section of Manual with neatly prepared flysheets briefly describing contents of ensuing section; flysheets may be in color.

Binding: Use heavy-duty plastic or fiberboard covers with binding mechanism concealed inside manual; 3-ring binders will be acceptable; binding is subject to Engineer's approval.

Measurements: Provide measurements in U.S. standard units (e.g., feet, inches, and pounds). Where items may be expected to be measured within 10 years in accordance with metric formulae, provide additional measurements in "International System of Units" (SI).

Provide front and back covers for each manual, using durable material approved by Engineer, and clearly identified on or through cover with at least following information:

OPERATING AND MAINTENANCE INSTRUCTIONS

Name and Address of Work

Name of Contractor

General subject of this manual

Space for approval signature of Engineer and approval date[s]

D. Contents: Include at least following:

1. Neatly typewritten index near front of Manual, giving immediate information as to location within manual of emergency information regarding installation.
2. Complete instructions regarding operation and maintenance of equipment involved including lubrication, disassembly, and reassembly.
3. Complete nomenclature of parts of equipment.

4. Complete nomenclature and part number of replaceable parts, name and address of nearest vendor and other data pertinent to procurement procedures.
5. Copy of guarantees and warranties issued.
6. Manufacturer's bulletins, cuts, and descriptive data, where pertinent, clearly indicating precise items included in this installation and deleting, or otherwise clearly indicating, manufacturers' data with which this installation is not concerned.
7. Other data as required in pertinent Sections of these Specifications.

1.18 EQUIPMENT FOUNDATIONS

A. Provide equipment foundations in accordance with provisions of these Specifications.

B. Provide concrete bases for main switchboard, distribution panelboards, floor-mounted transformers and other equipment that is to be pad- or floor-mounted. Bases shall be 4 inches high above finished floors or grades (unless otherwise noted) and shall protrude 2 inches beyond sides of equipment and shall have exposed chamfered edges. Construct bases from ready-mixed hard rock concrete, ASTM C94, reinforced with #3 Rebars, ASTM A615, Grade 40. Rebars shall be located at 18 inches on center each way.

C. Field-verify exact location of outdoor pad mounted equipment with Engineer. Supply necessary fill and grade site to provide natural drainage away from equipment.

D. Provide structural concrete foundations for generator, pad mounted transformers and lighting pole bases.

1.19 TESTING AND INSPECTION

A. Provide personnel and equipment, make required tests, and secure required approvals from Engineer and Governmental Agencies having jurisdiction. Reference Section 16050 for additional requirements.

B. Make written notice to Engineer adequately in advance of each of following stages of construction:
1. When rough in is complete, but not covered.
2. At completion of Work of this Division.
3. In underground condition prior to placing backfill, concrete floor slab, and when associated electrical Work is in place.

C. When material or workmanship is found to not comply with specified requirements, remove items from job site and replace them with items complying with specified requirements at no additional cost to Owner. This shall be performed within 3 days after receipt of written notice of noncompliance.

D. In Engineer’s presence, test parts of electrical system and prove that items provided under this Division function electrically in required manner.

1.20 SITE VISITS BY FACTORY PERSONNEL

A. Pay for travel expenses, living expenses, and miscellaneous expenses associated with site visits of factory personnel to perform on site testing, inspections, and reviews.

1.21 WARRANTY

A. Warrant equipment and workmanship for period of one year after date of substantial completion and replace or repair faulty equipment or installation at no cost to Owner for service during this period, in accordance with requirements of Division 1.

B. Warranty shall not void specific warranties issued by manufacturers for greater periods of time or void rights guaranteed to Owner by law.

C. Warranties shall be in writing in form satisfactory to Owner, and shall be delivered to Owner before final payment is made.

1.22 PROJECT COMPLETION

A. Upon completion of Work of this Division, thoroughly clean exposed portions of electrical installation, removing traces of soil, labels, grease, oil, and other foreign material, and using only type cleaner recommended by manufacturer of item being cleaned.

B. Thoroughly indoctrinate Owner's operation and maintenance personnel in contents of operations and maintenance manual required to be submitted as part of this Division of these Specifications.

END OF SECTION

SECTION 260503
THROUGH-PENETRATION FIRESTOPPING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 01 Specification sections, apply to work covered by this Section.

B. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of work.

1.2 DEFINITIONS

A. Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water and hot gases through penetrations in fire rated wall and floor assemblies.

1.3 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

Only tested firestop systems shall be used in specific locations as follows:

A. Penetrations for the passage of conduit and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

B. Completion of firestop installations to maintain the rating integrity of the barrier penetrated.

1.4 RELATED WORK OF OTHER SECTIONS

A. Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections.

1.5 REFERENCES

A. Test Requirements: ASTM E-814, "Standard Method of Fire Tests of Through Penetration Fire Stops" (July 1997).

B. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually.

1. UL Fire Resistance Directory:
    a. Through-Penetration Firestop Devices (XHCR)
    b. Fire Resistance Ratings (BXUV)
    c. Through-Penetration Firestop Systems (XHEZ)
    d. Fill, Voids, or Cavity Material (XHHW)
    e. Forming Materials (XHKU)

C. Inspection Requirements: ASTM E 2174-01 “Standard Practice For On-Site Inspection of Installed Fire Stops”.

D. International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

E. ASTM E-84, Standard Test Method for Surface Burning Characteristics of Building Materials.

F. All major building codes: ICBO, SBCCI, BOCA, and IBC.

G. NFPA 101 - Life Safety Code

H. NFPA 70 – National Electric Code.

1.6 QUALITY ASSURANCE

A. A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

B. Firestop System installation must meet requirements of ASTM E-814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated.

C. Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

D. Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the

structural engineer prior to penetrating any load bearing assembly.

E. For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994 as may be amended from time to time).

1.7 SUBMITTALS

A. Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 1300.

B. Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineer judgment must include both project name and contractor's name that will install firestop system as described in drawing.

C. Submit material safety data sheets provided with product delivered to job-site.

1.8 INSTALLER QUALIFICATIONS

A. Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacture's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.

B. Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

C. Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

D. Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

E. Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

A. Do not use materials that contain flammable solvents.

B. Scheduling

1. Schedule installation of CAST IN PLACE firestop devices **after** completion of floor formwork, metal form deck, or composite deck but **before** placement of concrete.
2. Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

C. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

D. Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

E. During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

PART 2 – PRODUCTS

2.1 FIRESTOPPING, GENERAL

A. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

B. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

C. Firestopping materials are either “cast-in-place” (integral with concrete placement) or “post installed”. Provide cast-in-place Firestop devices prior to concrete placement.

2.2 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:

1. Hilti, Inc., Tulsa, Oklahoma
   800-879-8000
2. Tremco Sealants & Coatings, Beechwood, Ohio
   (216) 292-5000
3. 3M Fire Protection Products, St. Paul, Minnesota
   (612) 736-0203
4. Johns-Manville Firetemp
5. Other manufacturers listed in the U.L. Fire Resistance Directory – Volume 2

2.3 MATERIALS

A. Use only firestop products that have been UL 1479, ASTM E-814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

B. Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic conduit penetrating concrete floors, the following products are acceptable:

1. Hilti CP 680 Cast-In Place Firestop Device
2. Hilti CP 681 Tub Box Kit
3. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

C, Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 604 Self-leveling Firestop Sealant
3. Hilti CP 620 Fire Foam
4. 3M Fire Stop Sealant 2000
5. 3M Fire Barrier CP25 WB
6. Tremco Tremstop Fyre-Sil Sealant
7. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

D. Sealants or caulking materials for use with sheet metal ducts, the following products are acceptable:

1. Hilti CP 601s Elastomeric Firestop Sealant
2. Hilti CP 606 Flexible Firestop Sealant
3. Hilti FS-ONE Intumescent Firestop Sealant
4. Hilti CP 604 Self-leveling Firestop Sealant
5. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

E. Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. 3M Fire Barrier CP25 WB
3. Tremco Tremstop WBM Intumescent Firestop Sealant
4. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

F. Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:

1. Hilti FS-ONE Intumescent Firestop Sealant
2. Hilti CP 620 Fire Foam
3. Hilti CP 618 Firestop Putty Stick
4. 3M Fire Barrier CP25 WB
5. Tremco Tremstop WBM Intumescent Firestop Sealant
6. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

G. Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
   1. Hilti CP 618 Firestop Putty Stick
   2. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

H. Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
   1. Hilti CP 617 Firestop Putty Pad
   2. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 1

I. Firestop collar or wrap devices attached to assembly around combustible plastic conduit, the following products are acceptable:
   1. Hilti CP 642 Firestop Collar
   2. Hilti CP 643 Firestop Collar
   3. 3M Fire Barrier PPD Plastic Pipe Device
   4. Hilti CP 645 Wrap Strip
   5. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

J. Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
   1. Hilti CP 637 Firestop Mortar
   2. Hilti FS 657 FIRE BLOCK
   3. Hilti CP 620 Fire Foam
   4. 3M Firestop Foam 2001
   5. 3M Fire Barrier CS-195 Composite Sheet
   6. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

K. Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
   1. Hilti FS 657 FIRE BLOCK
   2. Equivalent products listed in the U.L. Fire Resistance Directory – Volume 2

L. Provide a firestop system with an "F" Rating as determined by UL 1479 or ASTM E814, which is equal to the time rating of construction being penetrated.

PART 3 – EXECUTION

3.1 PREPARATION

A. Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
   1. Verify penetrations are properly sized and in suitable condition for application of materials.
   2. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
   3. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
   4. Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
   5. Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

A. Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

B. Responsible trade to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.3 INSTALLATION

A. Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.

B. Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

1. Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
2. Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

A. Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Inspection of through-penetration firestopping shall be performed in accordance with ASTM E 2174, “Standard Practice for On-Site Inspection of Installed Fire Stops” or other recognized standard.

D. Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

3.5 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 260519
WIRE AND CABLE (600 VOLTS)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of conductors as indicated on the Drawings and as specified.

B. Work included:

1. Wiring connections and terminations, 600 Volt rating and below.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the manufacturer's certifications that confirm that materials meet or exceed minimum requirements as specified.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Provide conductors made of soft-drawn, annealed copper with conductivity not less than that of 98% pure copper.

B. Building Wire:

1. Thermoplastic-insulated building wire: NEMA WC 5.
2. Feeders and branch circuits: Copper, stranded conductor, 600-volt insulation, THHN/THWN-2.
3. Control circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN-2.
4. Where more than one conductor of the same phase or more than one neutral conductor occurs at the same outlet or junction box, these conductors shall be identifiable from each other by use of stripes or distinguishing markings.
5. Use the following color code system:

	240/120 Volt Systems	208Y/120 Volt Systems	480Y/277 Volt Systems
Phase A	Black	Black	Brown
Phase B	Orange	Red	Orange
Phase C	Blue	Blue	Yellow
Neutral	White	White	Gray
Ground	Green	Green	Green
Switch	Purple	Purple	Purple

6. Type MC and AC cable shall not be used.

C. Remote Control and Signal Cable:
1. Control cable for Class 2 or Class 3 remote control and signal circuits: Copper conductor, 300-volt insulation, rated 60 ºC, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.
2. Plenum cable for Class 2 or Class 3 remote control and signal circuits: Copper conductor, 300-volt insulation, rated 60 ºC, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

2.2 ACCEPTABLE MANUFACTURERS

Provide products by the following manufacturers:
1. Rome
2. Cable
3. Pirelli
4. Belden
5. Or approved equal

PART 3 - EXECUTION

3.1 GENERAL WIRING METHODS (LESS THAN 600 VOLTS)

A. Install conductor sizes as indicated. Provide No. 10 AWG conductor for the entire circuit length for single-phase, 20-ampere circuits for which the distance from panelboard to the last outlet is more than 100 feet for 120-volt circuits or 200 feet for 277-volt circuits. The minimum wire size shall be 12 AWG for power and lighting circuits, and no smaller than 18 AWG for control wiring. Remote control wiring shall not be less than 14 AWG for installed lengths of 50 feet or less. Remote control conductors shall be increased one size (per NEC Table 310) for each additional 50 feet of length. Increase the raceway system to accommodate the increased wire size.

B. Provide an equal number of conductors of equal size for each phase of a circuit in same raceway or cable.

C. Splice only in junction boxes, outlet boxes, pullboxes, or manholes.

D. Neatly train and lace wiring inside boxes, equipment, and panelboards.

E. Make conductor lengths for parallel circuits equal.

F. Phasing shall be consistent throughout each installation from the service connection to every device connection and outlet. Where interface is made to an existing system, the existing phasing configuration shall be maintained.

3.2 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire-pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

3.3 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Support cables above accessible ceilings. Do not rest on ceiling tiles, light fixtures or air devices. Use spring metal clips or metal cable ties to support cables from structure. Include bridle rings or drive rings.

C. Use suitable cable fittings and connectors.

3.4 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible boxes or manholes.

B. Use solderless pressure connectors with insulating covers for copper wire splices and taps 8 AWG and smaller.

C. Use split bolt connectors for copper wire splices and taps 6 AWG and larger. Tape

uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

D. Thoroughly clean wires before installing lugs and connectors.

E. Make splices, taps and terminations to carry full capacity of conductors without perceptible temperature rise.

F. Terminate spare conductors with electrical tape.

G. Field Testing. Insulation resistance of all feeder conductors served by a protective device rated 200A or higher shall be tested. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps and connections are made except connection to or into its source and point (or points) of termination. Insulation resistance of conductors which are to operate at 600 volts or less shall be tested by using a Biddle Megger of not less than 1000 volts d-c. Insulation resistance of conductors rated at 600 volts shall be free of shorts and grounds and have a minimum resistance phase-to-phase and phase-to-ground of at least 10 megohms. Conductors that do not exceed insulation resistance values listed above shall be removed at Contractor's expense and replaced and test repeated. The Contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed, and shall forward copies of the test readings to the Owner in accordance with Section 260500. These test reports shall identify each conductor tested, date and time of test and weather conditions. Each test shall be signed by the party making the test.

3.5 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under applicable provisions of Division 26.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturers recommended values.

D. Perform continuity tests on all power and equipment branch circuit conductors. Verify proper phasing of all connections.

3.6 WIRE AND CABLE INSTALLATION SCHEDULE

A. All locations: Building wire in raceways.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 260526
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, apply to the work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's specifications and drawings for all requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of electrical systems grounding as shown or indicated on the Drawings and/or as specified.

B. Work Included:

1. Power systems grounding.
2. Electrical equipment and raceway grounding and bonding.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Engineer with the manufacturer's certificate that materials meet or exceed minimum requirements as specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide electrical grounding system indicated with assembly of materials, including but not limited to:

1. Wires and cables
2. Connectors
3. Terminals
4. Ground rods
5. Bonding jumper braid
6. Surge arrestors

B. Where materials or components are not indicated, provide products complying with NEC, UL, IEEE, and established industry standards for applications indicated.

2.2 CHEMICAL GROUND ROD

A. Self-contained ground rod(s) using electrolytically enhanced grounding shall be provided for power system grounding where indicated on the drawings. The ground rod shall operate by hygroscopically extracting moisture from the air to activate the electrolytic process improving performance. The ground rod system shall be UL listed and have been manufactured for a minimum of 10 years. The ground rod system shall be 100% self activating sealed and maintenance free. The system shall not require the addition of chemical or water solutions.

B. Electrode unit

1. The copper ground rod shall consist of 2” nominal diameter hollow copper tube with a wall thickness of not less than .083”. The tube shall be permanently capped on the top and bottom. Air breather holes shall be provided in the top of

the tube and drainage holes shall be provided in the bottom of the tube for electrolyte drainage into the surrounding soil. Shaft configuration: Straight Shaft Model No: K2-1020CS; UL Listing: 467.

2. The ground rod shall be filled from the factory with non-hazardous Calsolyte to enhance grounding performance.
3. Ground rod shall be twenty feet long for straight (vertical) installation.
4. A stranded 4/0 AWG Cu ground wire shall be Cadwelded to the side of rod for electrode conductor connection. A clamping “U-bolt” with pressure plate on the tip end of the tube shall be provided for testing and temporary connections.

C. Ground Access Box
1. Provide a precast concrete box with slots for conduit entrances. Minimum size shall be ten-inch diameter by twelve high. Provide a cast iron, flush traffic rated cover with “breather” slots, XIT model #XB-12.

D. Backfill Material
1. Natural volcanic, non-corrosive form of bentonite clay grout backfill material free of polymer sealant. XIT model #LNC.
2. Shall absorb approximately 14 gallons of water per 50# bag for optimal 30% solids density.
3. PH value 8-10 with maximum resistively of 3 ohm-m at 30% solids density.

E. Manufacturer: Lyncole XIT Grounding, 3547 Voyager St., Torrance, CA 90503, Phone 800-962-2610; or approved equal.

F. Ground Wire Termination: Exothermic connection to 4/0 conductor. U-bolt with pressure plate provided as test point.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install electrical grounding systems in accordance with applicable portions of NEC, with NECA's "Standard of Installation," and in accordance with recognized industry practices to ensure that products comply with requirements and serve intended functions.

B. Provide a separate, insulated equipment grounding conductor in feeder circuits. Terminate each end on a grounding lug, bus, or bushing.

C. Connect grounding electrode conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.

D. Installation of Chemical Ground Rod
1. Install a supplemental ground rod system in compliance with manufacturer’s instruction or recommendation.
2. Bore minimum 6” diameter hole, 6” deeper than the length of rod to be buried. Insure that the top of the copper chemical ground rod will not come in contact with the metal grate of the protective box or hand-hole cover.
3. Remove sealing tape from leaching holes.
4. Place chemical ground rod in hole, so that the top of unit is about 6” below grade.
5. Backfill.
6. Lynconite backfill is a specific clay (bentonite clay) included with the system. Mix each 50# backfill grout material with 14 gallons water to form a slurry and pour around chemical ground rod up to “bury to here sticker”.
7. Place protective box in accordance with the drawings
8. Remove sealing tape from the top breather holes to activate.
9. Connect grounding electrode conductor to ground rod pigtail exothermically (Cadweld or Thermoweld).
10. Bury grounding conductor 30” below grade. Cover conductor with a small amount of backfill for protection against corrosion.

3.2 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

B. Electrical Tests:
   1. Perform fall-of-potential test or alternative in accordance with IEEE Standard 81-1991 on the main grounding electrode or systems.
   2. Perform point-to-point tests to determine the resistance between the main grounding system and all major electrical equipment frames, system neutral, and/or derived neutral points.

C. Test Values:
   1. The resistance between the main grounding electrode and ground should be no greater than five ohms. Install additional grounding electrodes, as required, to achieve the specified resistance value.
   2. Investigate point-to-point resistance values which exceed 0.5 ohm. Correct deficiencies at no additional cost. Retest to prove compliance

D. Provide written certification to the Engineer that the grounding system has been tested and complies with the specified requirements.

E. Provide test report.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 260529
SUPPORTING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of support systems as shown or indicated on the Drawings and/or as specified.

B. Work Included:

1. Conduit and equipment supports
2. Fastening hardware
3. Other equipment to ensure a secure support system

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work in this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificates that confirm materials meet or exceed minimum requirements as specified.

PART 2 - PRODUCTS

2.1 HANGERS AND CLAMPS

A. Provide supporting devices of types, sizes, and materials indicated, and having the following construction features:

1. Clevis Hangers: For supporting 2" rigid metal conduit; galvanized steel; with 1/2" diameter hole for round steel rod, approximately 54 pounds per units.
2. Riser Clamps: For supporting 5" rigid metal conduit; black steel; with 2 bolts and nuts, and 4" ears, approximately 510 pounds per 100 units.
3. Reducing Couplings: Steel rod reducing coupling, 1/2" x 5/8", black steel, approximately 16 pounds per 100 units.
4. C-Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2", approximately 52 pounds per 100 units.
5. I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approximately 52 pounds per 100 units.
6. One-Hole Conduit Straps: For supporting 3/4" rigid metal conduit; galvanized steel; approximately 7 pounds per 100 units.
7. Two-Hole Conduit Straps: For supporting 3/4" rigid metal conduit, galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.
8. Hexagon Nuts: For 1/2" rod size; galvanized steel; approximately 4 pounds per 100 units.
9. Round Steel Rod: Black steel; 1/2" diameter; approximately 67 pounds per 100 feet.
10. Offset Conduit Clamps: For supporting 2" rigid metal conduit; black steel;

approximately 200 pounds per 100 units.

B. Anchors: Provide anchors of types, sizes, and materials indicated, and having the following construction features:
   1. Lead Expansion Anchors: 1/2", approximately 38 pounds per 100 units.
   2. Toggle Bolts: Springhead; 3/16" x 4"; approximately 5 pounds per 100 units.

C. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated; and having the following construction features:
   1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

D. Conduit Cable Supports: Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct for 2" rigid metal conduit; 3-wires, type wire as indicated; construct body of malleable iron casting with hot dip galvanized finish.

E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 16-gage hot dip galvanized steel, of types and sizes indicated; construct with 9/16" diameter holes, 8" O.C. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel:

Fixture hangers	Channel hangers
End caps	Beam clamps
Thin wall conduit clamps	Wiring stud
Rigid conduit clamps	Conduit hangers
U-bolts	

2.2 FABRICATED SUPPORTING DEVICES

A. Provide pipe sleeves of one of the following:
   1. Sheet Metal: Fabricate from galvanized sheet metal; round tube closed with snaplock joint, welded spiral seams, or welded longitudinal joint. Fabricate from the following gages: 3" and smaller, 20 gauge; 4" to 6", 16 gauge; over 6", 14 gauge.
   2. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.
   3. Iron Pipe: Fabricate from cast iron or ductile iron pipe; remove burrs.
   4. Plastic Pipe: Fabricate from Schedule 80 PVC plastic pipe; remove burrs.

B. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls, of one of the following:
   1. Dow # 790 Silicone Building Sealant by Dow Corning Corporation.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors, preset inserts, or beam clamps.

B. Install hangers, supports, clamps, and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with maximum spacing indicated.

C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or present inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

D. Do not fasten supports to piping, ductwork, mechanical equipment, or conduit.

E. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

F. Install freestanding electrical equipment on concrete pads.
G. Install surface-mounted cabinets and panelboards with minimum of four anchors.
H. Bridge studs top and bottom with channels to support surface and flush-mounted cabinets and panelboards in stud walls.
I. Tighten sleeve seal nuts until sealing grommets have expanded to form watertight seal.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 260533.13
RACEWAYS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of a complete and operating electrical raceway system, as indicated on the Drawings and as specified.

B. Work included:

1. Rigid metal conduit and fittings
2. Electrical metallic tubing and fittings
3. Flexible metal conduit and fittings
4. Non-metallic conduit and fittings
5. Surface-mounted raceway

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificates that confirm that materials meet or exceed minimum requirements as specified.

PART 2 - PRODUCTS

2.1 CONDUITS AND FITTINGS

A. Provide metal conduits, tubing, fittings, and couplings of types, grades, sizes, and weights (wall thickness) 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 Metal Conduit and Fittings

1. Rigid steel conduit: ANSI C80.1
2. Fittings and conduit bodies: ANSI/NEMA FB 1; threaded type, material to match conduit.

C. Electrical Metallic Tubing (EMT) and Fittings

1. EMT: ANSI C80.3 galvanized tubing
2. Fittings and Conduit Bodies: ANSI/NEMA FB 1; steel compression type

D. Flexible Metal Conduit and Fittings

1. Conduit: FS WW-C-566; steel
2. Fittings and Conduit Bodies: ANSI/NEMA FB 1

E. Liquid tight Flexible Conduit and Fittings

1. Conduit: Flexible metal conduit with PVC jacket
2. Fittings and Conduit Bodies: ANSI/NEMA FB 1

F. Plastic Conduit and Fittings

1. Conduit: NEMA TC 2; Schedule 40 PVC
2. Fittings and Conduit Bodies: NEMA TC 3

2.2 CONDUIT SUPPORTS

A. Conduit Clamps, Straps, and Supports: Steel or malleable iron.

PART 3 - EXECUTION

3.1 CONDUIT SIZING, ARRANGEMENT, AND SUPPORT

A. Size of conduit shall be as indicated on the drawings or sized for conductor type installed, whichever is larger. Size all conduits in accordance with the NEC. Minimum conduit size shall be ¾ inch.

B. Arrange conduit to maintain headroom and present a neat appearance.

C. Route exposed conduit and conduit above accessible ceilings parallel and perpendicular to walls and adjacent piping.

D. Maintain minimum 6-inch clearance between conduit and piping. Maintain 12-inch clearance between conduit and heat sources such as flues, steam pipes, and heating appliances.

E. Arrange conduit supports to prevent distortion of alignment by wire pulling operations. Fasten conduit using galvanized straps, lay-in adjustable hangers, clevis hangers, or bolted split stamped galvanized hangers.

F. Group conduit in parallel runs where practical and use conduit rack constructed of steel channel with conduit straps or clamps.

G. Do not fasten conduit with wire or perforated pipe straps. Remove all wire used for temporary conduit support during construction, before conductors are pulled.

3.2 CONDUIT INSTALLATION

A. Cut conduit square using a saw or pipe cutter; de-burr cut ends.

B. Bring conduit to the shoulder of fittings and couplings and fasten securely.

C. Use conduit hubs for fastening conduit to cast boxes and for fastening conduit to sheet metal boxes in damp or wet locations.

D. Install no more than the equivalent of three 90-degree bends between boxes.

E. Use conduit bodies to make sharp changes in direction, as around beams.

F. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 2-inches in size.

G. Avoid moisture traps where possible; where unavoidable, provide junction box with drain fitting at conduit low point.

H. Use suitable conduit caps to protect installed conduit against entrance of dirt and moisture.

I. Provide a pull tape for spare empty conduits. The tape shall be fiberglass reinforced polyester tape with distance marking in feet continuous along its length. Furnish T&B or Greenlee products.

J. Install expansion joints where conduit crosses building expansion joints.

K. Where conduit penetrates fire-rated walls and floors, provide mechanical firestop fittings with UL listed fire rating equal to wall or floor rating. Seal opening around conduit with UL listed foamed silicone elastomer compound.

L. Route conduit through roof openings for piping and ductwork where possible; otherwise route through roof jack with pitch pocket.

M. Maximum size conduit in slabs above grade: 3/4 inch.

N. Use PVC-coated rigid steel factory elbows for bends in plastic conduit runs longer than 100 feet or in plastic conduit runs, which have more than two bends regardless of length.

O. Make joints in accordance with manufacturers' written instructions.

P. Provide plastic warning tape for underground conduit or duct bank installations. Install warning tape directly above conduit one foot below finished grade or as shown on drawings. Reference Section 260553.

Q. Sand for intermediate fill around underground conduits shall be washed sand, suitable for concrete or masonry. Reference Section 260200 for additional backfill and excavation requirements.

3.3 CONDUIT INSTALLATION SCHEDULE

A. Underground installations more than two feet from foundation wall: Rigid steel conduit or Schedule 40 plastic conduit.
B. Installations in or under concrete slab, or underground within 2 feet of foundation wall: Rigid steel conduit
C. In slab above grade: Rigid steel conduit
D. Exposed outdoor locations: Rigid steel conduit.
E. Wet interior locations: Rigid Steel Conduit
F. Concealed dry interior locations: Electrical metallic tubing
G. Exposed dry interior locations: Electrical metallic tubing

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 260533.16
BOXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of outlets, pull and junction boxes as indicated on the Drawings and specified.

B. Work included:

1. Wall and Ceiling Outlet Boxes
2. Pull and Junction Boxes

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Engineer with manufacturer's certificates that confirm that materials meet or exceed minimum requirements as specified.

1.5 SUBMITTALS

A. Comply with the requirements specified in Division 01.

PART 2 - PRODUCTS

2.1 BOXES

A. Provide standard, stamped galvanized steel boxes except as hereinafter noted, by Steel City or approved equal.

B. Outlet Boxes

1. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 1/2 inch male fixture studs where required.
2. Cast Boxes: Aluminum or cast ferroalloy, deep type, gasket and cover, threaded hubs.

C. Pull and Junction Boxes

1. Sheet metal boxes: ANSI/NEMA OS 1, galvanized steel.
2. Sheet metal boxes larger than 12 inches in any dimension: Hinged enclosure in accordance with Section 26 2716.
3. Cast metal boxes for outdoor and wet location installation shall be NEMA 250;, Type 4 and Type 6, flat-flanged, surface-mounted junction boxes, UL listed as rain tight. Galvanized cast iron or cast aluminum box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
4. Cast Metal Boxes for Underground Installations: NEMA 250 Type 4, outside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron or cast aluminum box and plain cover with neoprene gasket and stainless steel cover screws.

2.2 FLOOR BOXES

A. Combination Flush Floor Boxes
   1. Where indicated in plan, furnish and install Wiremold/Walker Resource RFB series four compartment floor boxes.
   2. Boxes shall be Cast Iron, with a maximum depth of 3-7/16”.
   3. Compartment assignments shall be as follows:

FLUSH FLOOR BOX COMPARTMENT ASSIGNMENT SCHEDULE				
TRAINING ROOMS	A	50 CU. IN.	POWER - 0.75"C.	DUPLEX RECEPT.
	B	16.4 CU. IN.	TEL/DATA -1.25"C	DUAL BEZEL BRACKET
	C	32.3 CU. IN.	SPARE - 0.75"C	BLANK BRACKET
	D	16.4 CU. IN.	SPARE - 0.75"C	BLANK BRACKET

PART 3 - EXECUTION

3.1 COORDINATION OF BOX LOCATIONS
   A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
   B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned.
   C. Locate and install boxes to allow access.
   D. Locate and install to maintain headroom and to present a neat appearance.

3.2 OUTLET BOX INSTALLATION
   A. Do not install boxes back-to-back in walls. Provide a minimum 6-inch separation between boxes. Provide a minimum 24-inch separation between boxes in acoustic-rated walls.
   B. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.
   C. Provide knockout closures for unused openings.
   D. Support boxes securely and independently of conduit.
   E. Use multiple gang boxes where more than one device is mounted together. Do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.
   F. Install boxes in walls without damaging wall insulation.
   G. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.
   H. Position outlets to locate luminaires as shown on reflected ceiling plans.
   I. In inaccessible ceiling areas, position outlets and junction boxes within 6 inches of recessed luminaire, to be accessible through luminaire ceiling opening.
   J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.
   K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.
   L. Provide cast outlet boxes in exterior locations and wet locations.

3.3 PULL AND JUNCTION BOX INSTALLATION
   A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.
   B. Support pull and junction boxes independent of conduit.
   C. Set underground pull and junction boxes level and flush with finished grade.

END OF SECTION

SECTION 260553
ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of identification for electrical equipment as shown or as specified.

B. Work Included:

1. Nameplates and Tape Labels
2. Wire and Cable Markers
3. Buried Conduit Markers

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the manufacturer's certificates that confirm that materials meet or exceed minimum requirements as specified.

1.5 SUBMITTALS

A. Comply with the requirements in Division 01.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.

B. Wire and Cable Markers: Clothe markers, split sleeve or tubing type.

C. Buried Conduit Marker: Continuous printed plastic tape.

D. Outdoor Equipment Cables: Manufacturer's Standards

1. Weather and sun resistant.
2. Vandal resistant.

2.2 EQUIPMENT AND RACEWAYS OVER 600 VOLTS

A. Provide “WARNING - HIGH VOLTAGE - KEEP OUT” signs on all equipment. With 2-inch high lettering, mark exposed raceways containing conductors operating in excess of 600 volts every 100 feet with the words “WARNING - HIGH VOLTAGE”.

2.3 SPECIAL RACEWAY IDENTIFICATION

A. Special Systems. Brady Series 55200, 2" wide, pipe banding tape or colored conduit.

1. Fire Alarm: red
2. Telephone: blue
3. Data/Communications: blue
4. Low Voltage controls: black
5. Sound Systems: yellow

2.4 WIRE AND CABLE MARKERS

A. Lighting and Power Circuit Wire Markers.

1. Sizes #12 through 3/0 AWG. Brady SCN clip-sleeve wire markers.
2. Sizes 4/0 AWG and larger. Brady HSA heat shrink sleeves, custom printed.
3. Legends: Panel and circuit description; for example "EP1-1", "E1 - 2", "LPA-14".

2.5 EQUIPMENT AND WIRING DEVICE NAMEPLATES

A. General: White core laminated plastic. White lettering on black background, same style throughout.

B. Emergency Equipment Nameplates: White lettering on red background.

C. Fasteners: Stainless steel self-tapping screws. Use epoxy adhesive only when NEMA enclosure rating is compromised by screws and for wiring device nameplates.

D. Switchboard, Motor Control Center, Panelboard, Dry-type Transformer and Control Panel Main Nameplate: 5/8" high block letters.

E. Other Nameplates: 3/8" high block or condensed letters.

F. Legends:

1. General. Description as indicated on drawings, i.e., "PANEL EP-1", "XFRM ET-1", “TS-1".
2. Voltage. Description of operating voltage, i.e., “120 Volts”, “120/208 Volts”, “208 Volts”, “277/480 Volts”, or “480 Volts”, “Single Phase” or “Three Phase”.
3. Source: Description of source; i.e., "FED FROM PANEL EP-1, CKT. #1".

G. AIC Rating: Short Circuit current rating, fully rated; i.e., “10,000 Amperes, Fully Rated”,

2.6 PANELBOARD CIRCUIT BREAKER IDENTIFICATIONS

A. Manufacturer's standard labels supplied with panelboard.

2.7 CONTROL PANEL INTERIOR EQUIPMENT NAMEPLATES

A. White core laminated plastic. White lettering on black background, same style throughout, 3/8" high block or condensed letters.

2.8 TERMINAL IDENTIFICATIONS

A. Brady B-500 vinyl cloth pre-printed self-adhesive terminal markers. Legends: 1 through 96, A through Z.

2.9 FUSE IDENTIFICATION LABELS

A. Obtain original label from fuse box or carton or from fuse manufacturer, indicating manufacturer's name, fuse type, voltage and ampere rating. Attach with contact cement.

2.10 GROUND TERMINAL AND BUS IDENTIFICATION

A. Type: Green paint or dye, **factory** applied to terminal and bus.

B. Self-Adhesive Label Legend: "Ground", "Ground Bus", "Equipment Ground Bus" or "Isolated Ground Bus."

2.11 EMERGENCY FIXTURE AND OUTLET IDENTIFICATION

A. Self-adhesive red vinyl dots, 1/4" diameter. Brady QD-25-RD.

2.12 CONCEALED EQUIPMENT IDENTIFICATION

A. Brady ceiling tacks, 7/8" diameter with 7/16" long point.

1. Electrical equipment. #23255 (orange).
2. Fire alarm equipment. #23252 (red).

2.13 UNDERGROUND CONDUIT RUNS

A. Brady "Identoline" 6" wide over coated polyethylene film 3.5 mils thick, underground warning tapes.

1. Electric line. #91296 (red).
2. Telephone line. #91297 (orange).
3. Customized. Orange
   a.) Fire alarm line
   b.) Communications line
   c.) Data line
   d.) Data/communications line
   e.) Security line
   f.) CCTV line

2.14 DISTRIBUTION TRANSFORMER WARNING SIGN

A. Construction. Indoor/outdoor type, plastic or fiber glass, non-corrosive, impervious to weather.

B. Legend. "Danger" upper legend, white block letters on red panel on black panel. "High Voltage" lower legend, black condensed block letters on white.

C. Manufacturer. Brady, #71565.

D. Size. 7 inches high x 10 inches wide.

2.15 GENERATOR WARNING SIGNS

A. Construction. Indoor/outdoor type. Plastic or fiber glass, non-corrosive, impervious to weather.

B. Legend. "Danger" upper legend white block letters on red panel on black panel. "Warning" middle legend, red block letters on white panel, underlined in red. "This machine is automatically controlled" lower middle legend, black condensed block letters on white panel. "It may start at any time" bottom legend, red block letters on white panel.

C. Manufacturer. Brady, #47161.

D. Size. 7 inches high x 10 inches wide.

PART 3 – EXECUTION

3.1 GENERAL

A. Install nameplates, signs and labels, and engraved wall plates parallel to equipment lines. Embossed tape will not be permitted for any application.

3.2 INSTALLATION

A. Degrease and clean surfaces to receive nameplates.

B. Install nameplates parallel to equipment lines.

C. Secure nameplates to equipment fronts using stainless steel screws. Secure nameplate to inside face of recessed panelboard doors in finished locations.

D. Outdoor equipment labels shall be installed by the manufacturer as specified.

3.3 WIRE IDENTIFICATION

A. Provide wire markers on each conductor in panelboard gutters, pull boxes, and junction boxes, and at load connection. Identify with branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

3.4 NAMEPLATE ENGRAVING SCHEDULE

A. Provide nameplates to identify all electrical distribution and control equipment, and loads served. Letter Height: 1/4 inch for individual switches and loads served, 1/4 inch for distribution and control equipment identification.

3.5 EQUIPMENT NAMEPLATES

A. General: Identify panelboards, dry-type transformers and control panels with nameplates showing descriptions or designations on Drawings.

B. Identify disconnect and transfer switches with nameplates describing loads served and panelboard circuit controlling load.

C. Identify conduits, connected to pull and junction boxes, with nameplates describing the complete circuit number of the conductors contained in each conduit.

D. Identify receptacles, where the nominal voltage between contact pairs is greater than 150 volts, with nameplates describing the complete circuit number, voltage, and phases.

E. Identify wall switches, where the equipment served is not in sight of the wall switch, with nameplates describing the equipment served by the wall switches.

F. Locations.

1. Switchboards, Motor Control Centers, Distribution Panelboards. Locate main nameplate in center over top wiring gutter. Locate individual nameplates for switches and starters centrally on device doors. Locate individual nameplates

adjacent and to the side of circuit breakers.

2. Lighting and Appliance Panelboards. Locate main nameplate in center of cover approximately 2" down from top of panel.
3. Dry-type transformers. In middle of front cover panel.
4. Receptacles and Wall Switches. On wall directly above device plate.
5. Other equipment: In middle near top of equipment.

3.6 PANELBOARD CIRCUIT BREAKER IDENTIFICATIONS

A. General. Attach numbered identification to each panelboard circuit breaker in space provided by manufacturer.

B. Sequence. Arrange numbering to correspond to panelboard pole positions. For two pole breakers, number according to the upper pole only. For three pole breakers, number according to middle pole only. For multiple breakers occupying poles on both left and right side, number according to left side only.

C. Numbering Convention. Number poles from top to bottom. Utilize consecutive odd numbers for left side and consecutive even numbers for right side.

D. Separate Sub-feed Breakers. Number with last number of panelboard sequence.

E. Circuit Directory. Prepare a neatly typed circuit directory behind clear heat resistant plastic in a metal frame attached to the inside of the door for each panelboard. Identify circuits by equipment served and by room numbers where room numbers exist. Indicate spares and spaces with light, erasable pencil marking. An adhesive mounted directory pocket is not acceptable.

3.7 BURIED CONDUIT IDENTIFICATION

A. Underground-Type Plastic Line Marker: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick.

B. Provide tape with printing of "Buried Electrical Conduit" or other similar warning. Install directly above buried conduit one half the distance to conduit below finished grade.

END OF SECTION

SECTION 26 0950
ELECTRICAL WORK IN EXISTING FACILITIES

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 01 Specification sections, apply to work covered by this Section.

B. Comply with Division 26. Refer to other Divisions for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, materials, equipment, transportation, tools and services, and perform operations required for, and reasonably incidental to the providing or modification of electrical work and systems in existing facilities.

1.3 SHOP DRAWINGS

A. Show the joining of new work with existing, illustrating the actual existing conditions in accordance with Division 01.

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 SITE INSPECTION

A. The Contract Documents do not propose to show all existing systems material or equipment. Obtain information related to existing facilities from existing documents, measurements, notations, photographs, surveys and other observations at the site.

3.2 SCHEDULE OF WORK

A. Since the building will continue in use throughout the construction period, carry out the work under this Division in such a manner as to minimize disturbance to the occupants.

A. The schedule contemplates working in designated areas in the existing building while other adjacent areas are still being occupied. Carry out work in this Division in such a manner as to minimize disturbance to those occupied areas.

B. Should the work in the designated areas affect any services to the areas to remain in use, new permanent or temporary services or a combination of both shall be installed as required to enable those occupied areas to function properly.

C. Perform no work in the existing building which would interfere with its use during normal hours of occupancy, unless special permission is granted by the Owner. Included shall be operations which would cause objectionable noise or service interruptions.

D. Any work involving a service suspension shall be scheduled in advance with the Owner.

E. Should it be necessary to perform certain operations on an “overtime” basis in order not to interrupt the normal usage of the building, include the costs of such overtime without change in the Contract amount.

3.3 TEMPORARY WORKING ACCESS

A. Remove existing wire, conduit, equipment, fixtures, and other items as required to provide access for work in existing facilities.

B. Reinstall and refinish items removed, or otherwise damaged, to match existing adjacent conditions upon completion of the work.

3.4 DISRUPTION OF EXISTING FUNCTIONS

A. Access: Access to and use of the existing facilities and site will be restricted, and shall be under the direction and control of the Owner.

B. Outages: Schedule power outages to avoid interference with the Owner's or other tenant's activities. Obtain approval prior to the requested outage as specified in Division 01. Provide a schedule showing sequence and duration of all activities during the requested outage.

C. Disruptions: Maintain existing electrical, communications, alarm, and other existing systems, and maintain existing functions in service except for scheduled disruptions as specified in Division 01. Where existing functions to remain in use are disrupted, they shall be fully restored after disruption, in full compliance with this Division of the Specifications.

D. Duration: Complete as large a portion of the work as possible before initiating disruption and perform only that work necessary so as to minimize duration of disruption. Maintain adequate personnel, supplies, materials, equipment, tools, and other resources at job site to avoid unnecessary delay in resumption of normal service.

E. Schedule: Provide a complete schedule to the Owner for review and approval indicating the type and duration of any required disruption involved in the execution of the work.

3.5 SALVAGE, DEMOLITION AND RELOCATION

A. General:

1. Modify, remove, or relocate materials, equipment and devices as indicated or required by the installation of new facilities.
2. Working jointly with the Owner's Representative, establish and mark salvage and demolition items before commencing work; report items scheduled for relocation, reinstallation or reuse, which are found to be in damaged condition; await further instructions from the Owner before commencing with work.
3. Demolition material shall be removed from the site and disposed of by the Contractor. Salvaged equipment and devices shall be the property of the Owner unless noted otherwise. Store or dispose of as directed by Owner.

B. Relocations:

1. Make minor relocations necessitated by the conditions at the site or as directed by the Owner's Representative, without additional cost to the Owner.
2. Repair and restore to good functional condition, equipment, materials and items scheduled for relocation, which are damaged during dismantling or reassembly operations.
3. New materials and items of similar design and quality may be substituted for materials and items indicated to be relocated upon approval of Shop Drawings, product data, and samples.
1. Remove carefully, in reverse order to original assembly or placement, items which are to be relocated.
2. Protect items until relocation is complete.
3. Clean and repair items to be relocated, and provide new materials, fittings, and appurtenances required to complete the relocations and to restore to good operating order.
4. Perform the relocation work in full compliance with this Division of the Specifications, utilizing skilled workers.

C. Relocating Devices:

1. Remove and reinstall in locations designated by the Owner's Representative wiring devices, fixtures, equipment, other devices and associated wire and conduit required for the operation of the various systems that are installed in existing-to-be-removed construction.

END OF SECTION

SECTION 262416
PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of electrical panelboards as shown or indicated on the Drawings and/or as specified.

B. Work Included

1. Power distribution panelboards.
2. Lighting and branch circuit panelboards.

1.4 SUBMITTALS

A. Reference Section 260500 for detailed requirements.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the manufacturer's certification that materials meet or exceed minimum requirements as specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Panelboards shall be manufactured by one of the following:

1. Siemens Energy and Automation
2. General Electric Company
3. Square D Schneider Electric
4. Eaton Corporation

2.2 PANELBOARDS (GENERAL)

A. Panelboards shall be listed by Underwriters Laboratories, Inc. (UL), and shall be so labeled, rated for intended voltage and current characteristics as scheduled.

B. Cabinets for panelboards shall be by NEC gage sheet steel having steel doors and trim to conform to the cabinet mounting. The trim on cabinets shall be made adjustable with the door. Door shall be mounted with heavy concealed hinges.

C. Cabinets shall have wiring space top, bottom and both sides in accordance with the National Electrical Code, but no less than 4-inches wide, with standard knockouts.

D. Provide a clear, plastic-covered, typed directory card and cardholder on the inside of each door. Key locks alike, and provide the Owner with not less than 5 keys. Finish shall be gray enamel over a rust inhibitor, except cans may be galvanized.

E. Multisection panels shall be same height and depth.

F. Interiors shall be completely factory assembled, and shall consist of rigid frame supporting the rectangular bus, mains, neutral and ground bars. Bussing shall be sized in accordance with UL Standards, braced throughout to conform with industry standards governing short circuit stresses in panelboards, and arranged for sequence phasing

throughout. Bussing shall be tinned copper.

G. Phase bussing shall be full height without reduction, full size neutral, unless otherwise scheduled, with suitable lug for each outgoing circuit requiring a neutral connection. Provide ground bus with suitable lugs for each branch circuit ground conductor.

H. Terminals for feeder conductors, branch circuit devices and neutrals shall be UL listed as suitable for type of conductors specified.

I. Interiors shall be designed such that circuit protective devices may be changed, replaced, or additional circuits added without disturbing adjacent units and without machining, drilling or tapping. In no case shall the width of panelboard enclosure be less than 20-inches. Branch circuit breakers shall be bolt-in type.

J. Enclosures

1. Circuit switching/protective devices shall be housed in an enclosure suitable for the environment in which they are located.
2. Normal indoor locations - NEMA 1 general purpose.
3. Outdoor or vault locations - NEMA 3R.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Provide dead-front safety type power distribution panelboards as indicated, with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn solderless pressure type main lug connectors approved for copper conductors. Equip with copper bus bars with not less than 98% conductivity, and with full-sized neutral bus; provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections.

B. Provide bolt-in type heavy-duty molded-case branch circuit breaker types for each circuit, with toggle handles that indicate when tripped. Where multiple-pole breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Provide panelboards with bare un-insulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate properly with panelboards.

C. On multisection and split-bus panels, the lugs and bus on each and every section shall be of the same current rating as the main overcurrent device protecting the feeder serving the panel and each section shall have a separate neutral, ground bar and conductors. Panel bus shall have double lugs to effect parallel feed of bus bars (rather than series) where scheduled. Feed-thru lugs are not acceptable.

2.4 LIGHTING AND BRANCH CIRCUIT PANELBOARDS

A. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangements shown; with anti-burn solderless pressure type lug connectors approved for copper conductors.

B. Equip with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, single-pole circuit breakers, with toggle handles that indicate when tripped. Interrupting rating shall be in excess of the available fault current at the panel in accordance with UL listings for sizes involved, but no less than 10,000 rms symmetrical amperes. Provide common trip on multi-pole circuit breakers.

C. Provide suitable lugs on neutral bus for each outgoing feeder required; provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards, which mate properly with panelboards.

D. On multi-section and split-bus panels, the lugs and bus on each and every section shall be of the same current rating as the main overcurrent device protecting the feeder serving the panel and each section shall have a separate neutral, ground bar and conductors. Panel bus shall have double lugs to effect parallel feed of bus bars (rather than series) where scheduled. Feed-thru lugs are not acceptable.

2.5 INDIVIDUALLY MOUNTED CIRCUIT BREAKERS

A. Individually mounted circuit breakers shall be molded case, capacity as indicated, in a NEMA Type 1 enclosure unless otherwise noted. Breakers shall be quick-make/ quick-break thermal magnetic common trip type, ambient compensated with trip-free

handle and have interrupting rating in accordance with UL listings for sizes required, but not less than 10,000 amperes RMS symmetrical, and conform to requirements of NEMA Standard Publication No. AB1-1969. Each unit shall have insulated neutral and/or ground terminal of proper size, where indicated. Lugs shall be UL listed for copper cables.

B. Enclosures
   1. Circuit switching/protective devices shall be housed in an enclosure suitable for the environment in which they are located. Provide lifting eyes or brackets.
   2. Normal indoor locations - NEMA 1 general purpose.
   3. Outdoor or vault locations - NEMA 3R.

C. Circuit breakers shall be of same manufacturer as panelboards.

2.6 PANELBOARD ACCESSORIES

A. Provide panelboard accessories and devices as recommended by panelboard manufacturer for ratings and applications indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC standards and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate installation of panelboards and enclosures with cable and raceway installation work.

C. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure. Provide cross channels at top and bottom in stud walls to support panels.

D. Provide properly wired electrical connections within enclosures.

E. Prepare and affix typewritten directory to inside cover of panelboard indicating loads controlled by each circuit.

F. Install wall-mounted panelboards a maximum of 6 feet 6 inches above finish floor to top of panel.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 262700
ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of electrical service from the utility company transformer location to the main switchboard as shown or indicated on the drawings and/or as specified.

B. Work included:

1. Install primary conduits, furnished by BTU and as directed by BTU.
2. Install a pad-mounted, medium voltage switch and pad mounted transformer, furnished by BTU. Coordinate the exact location, and orientation with BTU.
3. Furnish and install conduits, wires, transformer pads, switchboard pads, and metering equipment to provide an electrical service entrance as shown on the drawings and/or specified herein. Coordinate work with the electric utility company, verify all requirements, and install service entrance equipment in exact compliance with utility company and local governmental agency requirements.
4. Arrange with the electric utility company to inspect the work and include all utility charges and costs related to the installation of the electric service.

1.4 SYSTEM DESCRIPTION

A. Underground service entrance.

B. System Voltage: 208/120 volts, 3 phase, 4 wire, 60 hertz.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

PART 2 - PRODUCTS

2.1 METERING EQUIPMENT

A. All metering shall be furnished and/or installed, as directed by the electric utility company. Install equipment and furnish current transformer cabinet as required at no additional cost to the Owner.

2.2 RACEWAYS AND FITTINGS

A. Provide the excavation and backfill of conduit trench for primary and secondary conduits. Arrange with the electric utility to inspect the conduits before backfilling the trench. Correct all deficiencies

B. Conduit elbows shall be factory manufactured, rigid galvanized steel conduit, 24 inch minimum long radius, sweep bends. Apply corrosion protective tape, half lapped, to elbows.

2.3 TRANSFORMER & SWITCH PADS

A. Determine the required transformer pad and medium voltage switch dimensions from the

electric utility. Refer to the structural drawing for the required structural elements. Arrange with the utility to inspect the pad forms, prior to the concrete pour. Correct all deficiencies.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install service-entrance equipment as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices, to ensure that service-entrance equipment fulfills all requirements. Comply with applicable installation requirements of NEC and NEMA standards.

B. Coordinate with other work, including utility company wiring, as necessary to interface installation of service-entrance equipment work with other work.

END OF SECTION

SECTION 262716
CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of electrical cabinets and enclosures as indicated on the Drawings and as specified.

B. Work included:

1. Hinged cover enclosures.
2. Cabinets.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide manufacturer's certificates that confirm the materials meet or exceed minimum requirements as specified.

1.5 SUBMITTALS

A. Comply with the requirements specified in Division 01.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

A. Construction: NEMA 250, steel.

B. Type:

1. Indoor locations - NEMA Type 1
2. Outdoor locations - NEMA Type 3R

C. Finish: Manufacturer's standard gray enamel finish.

D. Covers: Continuous hinge, held closed by flush vandal-resistant latch operable by key. Make keys interchangeable with new enclosures of the same voltage and use.

E. Panel for Mounting Terminal Blocks or Electrical Components: 14 gage steel, manufacturer's standard gray enamel.

2.2 CABINETS

A. Cabinet Boxes: Galvanized steel with removable end walls, 24 inches wide 10 inches deep. Provide ¾-inch-thick, plywood backboard painted matte white, for mounting terminal blocks.

B. Cabinet Fronts: Steel, surface type with concealed trim clamps, screw cover front concealed hinge and flush lock keyed to match branch circuit panelboard; finish in gray baked enamel.

C. Provide identification label. Reference Section 26 0553.

2.3 FABRICATION

A. Shop assembled enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

B. Provide knockouts on enclosures.

C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosures.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cabinets and enclosures plumb, and anchor securely to wall and structural supports at each corner, minimum.

B. Provide accessory feet for free-standing equipment enclosures.

C. Install trim plumb minimum 6'-6" from finished grade or floor to top of enclosure.

END OF SECTION

SECTION 262726
WIRING DEVICES

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Division 01 Specification sections, apply to work covered by this Section.

B. Comply with Division 26 Sections, as applicable. Refer to other Divisions for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of wiring devices, including related systems and accessories.

B. Include labor, material, equipment, tools and services for the installation of 8 additional standard wiring devices to be added during construction.

1.3 SUBMITTALS

A. Submit product data and shop drawings in accordance with Division 01 for products specified under PART 2 - PRODUCTS.

1.4 REFERENCE STANDARDS

A. The wiring devices specified herein shall be designed, manufactured, tested and installed according to the latest version of the following standards:

1. National Electrical Manufacturers Association (NEMA) WD-1
2. Federal Specification (FS) WC-596
3. Federal Specification (FS) WS-896
4. Underwriters Laboratories (UL)

B. All wiring devices shall be UL listed.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pass & Seymour
B. Hubbell
C. Leviton
D. Cooper

2.2 RECEPTACLES

A. General:

1. Receptacles shall be standard or decorative style as indicated herein. They shall be constructed of high-impact resistant thermoplastic material with a nylon face and thermoplastic back body. Unless noted otherwise, they shall be 2-pole, 3-wire with a green equipment ground screw or an automatic grounding system attached to the strap.
2. Receptacle color shall be white unless noted otherwise.
3. Receptacles used for emergency power branch circuits shall be red.

B. Hospital Grade:

1. Hospital Grade receptacles shall be standard style. The face and back body shall be constructed of a high-impact resistant thermoplastic with an identifying green dot on the face to signify Hospital Grade. The contacts shall be a triple wipe, T-slot, one-piece copper alloy design. The device shall have a green ground screw or an automatic grounding system attached to the strap. The strap shall be a wrap-around type interlocked into the body in at least 4 points. The strap and device body shall be assembled with 6 mechanical fasteners. The device shall be 20-ampere, 125-volt, NEMA configuration 5-20R, back and side-wired.

C. Specification Grade:

1. Specification Grade receptacles shall be standard style. The face shall be constructed of a high-impact resistant thermoplastic. The contacts shall be a triple wipe, T-slot, one-piece copper alloy design. The device shall have a green ground screw or an automatic grounding system attached to the strap. The device shall be 20-ampere, 125-volts, NEMA configuration 5-20R, back and side-wired.

D. Special purpose receptacles shall be of the specific NEMA configuration indicated on the Drawings.

E. Ground Fault Circuit Interrupter (GFCI):
1. GFCI receptacles shall be a feed-through type wired for single receptacle protection thus not affecting receptacles downstream on the same circuit. They shall be UL rated Class 1 with 5-milliampere ground fault trip level and a 20-ampere feed-through rating. GFCI receptacles shall be NEMA configuration 5-20R.

F. Isolated Ground (IG):
1. Isolated ground receptacles shall be standard style. The contacts shall be a triple wipe, T-slot, one-piece copper alloy design. The ground contacts shall be isolated from the mounting strap and conduit system. The device shall have a green ground screw that totally isolates the grounding contacts, and it shall require that the insulated ground conductor run uninterrupted to the neutral at the service entrance. The device shall also have an automatic grounding system and center rivet attached to the mounting strap allowing the use of a metal wall plate. The device shall carry an identifying triangle on the face to signify Isolated Ground. The device shall be 20-ampere, 125-volts, NEMA configuration 5-20R, back and side-wired, orange.

G. Tamper Resistant:
1. Tamper resistant safety receptacles shall consist of safety shutters that, when not in use, are in a closed position and cover access to contacts. The contacts shall be a T-slot, one-piece copper alloy design. The device shall be 20-ampere, 125-volts, NEMA configuration 5-20R, back and side-wired.

H. Transient Voltage Surge Suppressor (TVSS) :
1. TVSS receptacles shall provide surge protection of not less than 80 joules in all three modes; line to neutral, line to ground, neutral to ground. TVSS receptacles shall provide RFI and EMI noise filtration of not less than 7:1 reduction. TVSS receptacles shall be of heavy duty Hospital Grade construction and provide back and side-wired termination. TVSS receptacles shall be provided with a long life LED and a wide angle viewing lens for positive indication of surge protection. TVSS receptacles shall meet UL 1449 and be IEEE/ANSI 62.41-1 (latest revision), approved. TVSS receptacles shall be 20-ampere, 125-volts, NEMA configuration 5-20R, back and side wired.

I. Isolated Ground Transient Voltage Surge Suppressor (IG-TVSS):
1. IG-TVSS receptacles shall comply with the TVSS receptacle requirements indicated above. The ground contacts shall be isolated from the mounting strap and conduit system. IG-TVSS receptacles shall have a green ground screw that totally isolates the grounding contacts, and it shall require that the insulated ground conductor run uninterrupted to the neutral at the service entrance. The receptacle shall carry an identifying triangle on the face to signify Isolated Ground. The receptacle shall be 20-ampere, 125-volts, NEMA configuration 5-20R, back and side-wired, orange.

2.3 SWITCHES

A. General:
1. Switches shall be toggle or decorative rocker type as indicated herein. The body of the switch shall be made of an arc-resistant thermoset material. All toggle switch handles shall be constructed of a thermoplastic material. All rocker switch handles shall be constructed of a thermoset material. All wall switches shall be of the quiet AC type.
2. Switches shall be SPST, DPST, 3-way or 4-way as indicated on the Drawings.
3. Switch color shall be white unless noted otherwise.
4. Switches used for emergency power branch circuits shall be red.

B. Hospital Grade:
1. Hospital Grade switches shall be toggle type. The contact arms shall be made of one-piece copper alloy material. The switch shall include a green ground screw attached to the mounting strap. The switch shall be 20-ampere, 120 volts AC, horsepower rated, back and side-wired.

C. Specification Grade:

1. Specification Grade switches shall be toggle type. The contact arms shall be made of one-piece copper alloy material. The switch shall include a green ground screw attached to the mounting strap. The switch shall be 20-ampere, 120 volts AC, horsepower rated, back and side-wired.

D. Pilot Lighted:
1. Pilot lighted switches shall be toggle type. The toggle shall be red, green or clear as indicated on the Drawings. The toggle shall illuminate when the switch is in the ON position. The device shall be 20-ampere, 120 volts AC, back and side-wired.

E. Lighted:
1. Lighted switches shall be toggle type. The switch shall glow when the switch is in the OFF position. The device shall be a 20-ampere, 120 volts AC, back and side-wired.

F. Locking:
1. Locking switches shall be 20-ampere, 120 volts AC, back and side-wired, gray. The switch shall be furnished with minimum two (2) keys.

G. Security:
1. Security switches shall be operated by cam lock for maximum security in critical areas. The device shall be 20-ampere, 120 volts AC, back and side-wired. The switch shall be furnished with minimum two (2) keys.

H. Incandescent Wallbox Dimmers:
1. Manufacturer
   a.) Lutron
   b.) Leviton
2. Performance
   a.) All devices shall be capable of operating at rated capacity without adversely affecting design lifetime.
   b.) All devices shall mount individually in a single gang switchbox. Devices shall be gangable without removing side sections or derating capacity.
   c.) Devices shall operate in an ambient temperature range of 0°C (32°F) to 40°C (104°F).
   d.) All dimmers and switches shall incorporate an air gap switch which shall be accessible without removing the faceplate. The air gap switch shall be capable of meeting all applicable requirements of UL 20 for air gap switches in incandescent dimmers.
   e.) All dimmers and switches shall provide power-failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable, unless noted otherwise.
   f.) Dimmers and switches shall not be susceptible to damage or loss of memory due to static discharge.
   g.) Dimmers and switches shall be tested to withstand voltage surges of up to 600V and current surges of up to 200A without damage per ANSI/IEEE std. C62.41-1980.
   h.) Dimmers and switches shall meet the UL 20 limited short circuit test requirement for snap switches.
3. Dimmer Controls
   a.) Dimmer control of light intensity shall be via a linear slide.
   b.) Linear slide dimmer shall provide intensity and on/off control with movement of slider. This shall apply to single pole and 2-location dimmers.
   c.) Dimmer shall include voltage compensation circuitry that adjusts the firing angle of the dimmer in such a manner as to compensate light output for variations in the AC line voltage. Dimmers in which the firing angle is merely held constant with varying AC line voltage shall not be acceptable.
   d.) All dimmers shall provide a smooth and continuous Square Law Dimming curve.
   e.) Dimmers shall utilize a filtering network to minimize interference with properly installed radio, audio and video equipment.

f.) All dimmers shall meet UL 20 and be appropriately marked.

4. Switches
   a.) All dimmer related on/off switches shall be single pole, 3-Way and 4-Way configuration as indicated on the Drawings.
   b.) Switch rating shall be 20A, 120 VAC, for tungsten or inductive loads.
5. Wall Plates
   a.) Wall plates shall include mounting frame for proper device alignment and faceplate attachment.
   b.) Wall plates shall be constructed of high impact, scratch-resistant ABS plastic. Color shall be ivory unless noted otherwise.
   c.) Wall plates shall snap on to device with no visible means of attachment.
   d.) Heat fins shall not be visible on front of device.
   e.) At locations with multiple devices, one seamless, multi-gang faceplate shall be provided. Coordinate proper switch box size and wall plate type.

2.4 WALL PLATES

A. Wall plates shall be provided for all switches, receptacles, blanks, telephone and special purpose outlets. The wall plates shall be of suitable configuration for the device for which it is to cover with color matched mounting screws. Color of the wall plates shall match the device, unless noted otherwise.

B. Wall plates shall be plastic. They shall be thermoplastic, non-combustible and high-impact resistant. They shall be P-line smooth plates.

2.5 FLOOR BOXES

A. Multi-section Stamped-Steel Recessed Floor Box
   1. Four-compartment combination box with two duplex receptacle brackets, two 20A. Receptacles, two communication brackets.

PART 3 – EXECUTION

3.1 INSTALLATION OF WIRING DEVICES

A. Each wiring device shall be mounted in a metallic outlet box. In general, devices in finished spaces shall be flush mounted and devices in unfinished spaces, i.e. mechanical and electrical equipment rooms shall be surface mounted. Verify the requirements of all spaces with the Architect.

B. Wall Plates
   1. Each device shall have a cover plate appropriate for the application.
   2. Cover plates shall be installed true and plumb with building lines, mortar joints and architectural features.
   3. Adjacent devices shall be mounted under a common cover plate suitable for the application.
   4. At locations with multiple devices, one seamless, multi-gang faceplate shall be provided. Coordinate proper switch box size and wall plate type.

C. Mount receptacles and special systems outlets above finish floor to the device centerline, unless noted or required otherwise.

D. Place conductor under wiring device screw terminals and draw up snugly.

E. Mount switches above finish floor to the device centerline and 6" from a door strike, unless noted or required otherwise.

F. Grounding continuity shall be maintained between devices and metallic raceway system in addition to the green equipment grounding conductor run with circuit conductors. Care shall be taken when installing receptacles having an isolated ground pole so as to not bond the equipment ground conductor to the conduit system.

G. Wire each receptacle using correct polarity (i.e., neutral to neutral terminal, etc.).

H. Mount receptacles throughout the project with ground pole at the top of the configuration when mounted vertically, on the right when horizontally mounted.

I. All exterior wiring devices shall be provided with a weatherproof cover/enclosure. Exterior receptacles shall be GFCI type.

J. De-rate dimmer capacity as required by the manufacturer if side sections are removed.

K. Run separate neutral wire for each phase of a three phase system when dimmers are installed on multiple phases and for each dimmer when multiple dimmers are installed on the same phase.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 262726.13
OCCUPANCY SENSORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all labor, materials, tools, appliances, control hardware, sensor, wire, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as described herein.

B. Examine all general specification provisions and drawings for related electrical work required as work under Division 26.

C. Coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, fixtures, HVAC systems and building management systems.

1.4 EQUIPMENT QUALIFICATION

A. Products supplied shall be from a single manufacturer that has been continuously involved in the manufacturing of occupancy sensors for a minimum of five (5) years. Mixing of manufacturers shall not be allowed.

B. All components shall be U.L. listed, offer a five (5) year warranty and meet all state and local applicable code requirements.

C. Products shall be manufactured by an ISO 9002 certified manufacturing facility and shall have a defect rate of less than 1/3 of 1%.

D. Wall switch products must be capable of withstanding the effects of inrush current. Submittals shall clearly indicate the method used.

1.5 SYSTEM DESCRIPTION

A. Ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control system shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Warrant all equipment furnished in accordance to this specification to be undamaged, free of defects in materials and workmanship, and in conformance with the specifications. The work shall include repair or replacement, and testing without charge to the owner, all or any parts of equipment which are found to be damaged, defective or non-conforming and returned to the supplier. The warranty shall commence upon the owner's acceptance of the project. Warranty on labor shall be for a minimum period of one (1) year.

D. Provide a light switch in each room as shown or as specified in section 262726.

1.6 SUBMITTALS

A. Substantiate conformance to this specification by submitting the necessary documents, performance data and wiring diagrams. Any deviations to this specification must be clearly stated by letter and submitted.

B. Submit a lighting plan clearly marked by the manufacturer showing proper product, location and orientation of each sensor.

C. Submit standard catalog literature that includes performance specifications indicating compliance to the specification.

D. Catalog sheets must clearly state any load restrictions when used with electronic ballasts.

1.7 SYSTEM OPERATION

A. Make all proper adjustments to assure owner's satisfaction with the occupancy system.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The Watt Stopper, Sensor Switch, Leviton, Novatas or Mytec.

B. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the electrical contractor to ensure that any price quotations received and submittals made are for sensors that meet or exceed the specifications included herein.

2.2 PRODUCTS

A. **Passive infrared sensors** shall utilize Pulse Count Processing and Digital Signature Analysis to respond only to those signals caused by human motion. Passive infrared sensors shall only be used in corridors or hallways. Provide a wall switch infrared sensor with ON/OFF switching in janitor rooms, storage rooms with limited shelving

B. Passive infrared sensors shall utilize mixed signal ASIC which provides high immunity to false triggering from RFI (hand-held radios) and EMI (electrical noise on the line), superior performance, and greater reliability.

C. Passive infrared sensors shall have a multiple segmented Lodif Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up.

D. **Dual technology sensors** shall be corner mounted to avoid detection outside the controlled area when doors are left open. Dual technology sensors shall be used in toilets, rooms with partitions, open offices with cubicles, cafeterias and storage rooms or warehouses with shelving.

E. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

1. The Dual Technology sensor shall be capable of detecting presence in the control area by detecting doppler shifts in transmitted ultrasound and passive infrared heat changes.
2. Sensor shall utilize Dual Sensing Verification Principle for coordination between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.
3. Sensor shall be capable of corner mounting to a wall or ceiling in order to eliminate detection through open doorways and outside of controlled area. To provide superior small motion detection and immediate activation upon entry, coverage of both technologies must be complete and overlapping throughout the controlled area.
4. To avoid false ON activations and to provide immunity to RFI and EMI, Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

F. **Low Voltage Digital Time Switch**: The digital time switch shall be programmable to turn loads off after a preset time. Time switch shall be a five terminal, completely self-contained control system that replaces a standard toggle switch. Switching mechanism shall be a 30V @ 1A air gap relay.

1. Time switch shall operate at either 24 VAC/VDC/VAC-half wave rectified. Time switch shall be capable of operating as an ON/OFF switch.
2. Time switch shall have no minimum load requirement. Time-out period shall be adjustable in increments of 5 minutes from 5 minutes to 1 hour, and in increments of 15 minutes from 1 hour to12 hours.

G. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

H. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

I. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

J. In the event of failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain on constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

K. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

L. Where specified, sensor shall have an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

PART 3 - EXECUTION

3. 1 INSTALLATION

A. Locate and aim sensory in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall have ninety (90) to one hundred (100) percent coverage to completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors as required to properly and completely cover the respective room.

B. Meet with the manufacturer's factory authorized representative, at the owner's facility, to verify placement of sensors and installation criteria.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 262816
DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, material, labor, supervision, and services necessary for or incidental to the installation of disconnect switches as shown or indicated on the Drawings and/or as specified.

B. Work Included:

1. Circuit disconnects
2. Motor disconnects

1.4 SUBMITTALS

A. Reference Division 01 and 26 0500 for detailed requirements.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide disconnect switches manufactured by one of the following:

1. General Electric Company
2. Siemens Energy and Automation
3. Square D Schneider Electric
4. Eaton, Cutler Hammer

2.2 HEAVY-DUTY SAFETY SWITCHES

A. Provide surface-mounted, heavy-duty type, sheet-steel enclosed safety switches, of types, sizes and electrical characteristics indicated; fusible type, rated 600 volts, and incorporating quick-make, quick-break type switches; construct so that switch blades are visible in OFF position with door open. Equip with operating handle which is pad lockable in OFF position; construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts, and positive pressure type reinforced fuse clips. Provide NEMA Type 3R enclosures at exterior equipment.

2.3 COMPONENTS

A. Motor and circuit disconnects shall have an Underwriters' Laboratory label.

B. Single Phase Disconnect Switches: Two pole toggle switch equal to Square D Type F with thermal overloads in appropriate enclosure.

C. Three Phase Motor Disconnect Switches: 3 pole heavy duty 250 or 600 volt as required in NEMA Type 1 or 3 enclosures as indicated and as required.

D. Enclosures

1. Normal indoor locations – heavy duty NEMA 1.

2. Outdoor or wet locations – heavy duty NEMA 3R

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install circuit and motor disconnect switches as 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.

END OF SECTION

SECTION 262913
MOTOR STARTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of motor starters for all electric motor driven equipment as shown or indicated on the drawings and/or as specified.

B. Work Included:

1. Manual motor starters
2. Magnetic motor starters.
3. Combination motor starters

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the manufacturer's certificates that confirm that materials meet or exceed minimum requirements as specified.

1.5 SUBMITTAL

A. Provide written certification from manufacturer that equipment and materials provided under this Division meet specified compliance requirements.

B. Comply with the requirements specified in Division 01 and Sections 260500.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Provide motor starters as manufactured by one of the following:

1. General Electric Company
2. Siemens Energy and Automation
3. Square D Schneider Electric
4. Eaton, Cutler Hammer

2.2 MANUAL MOTOR STARTERS

A. Provide single-phase, horsepower rated manual motor starters, of sizes and ratings indicated. Equip with manually operated quick-make, quick-break toggle mechanisms; and with one-piece melting alloy type thermal units. Starter to become inoperative when thermal unit is removed. Provide starters with double break, silver alloy contacts, visible from both sides of starter, green pilot lights, and switch capable of being padlocked “OFF”.

B. Provide surface mounted starters in NEMA Type 1 or Type 3 enclosure as required.

2.3 MAGNETIC MOTOR STARTERS

A. Provide fused disconnect switches complete with time delay fuses.

B. Provide contactors with three overload relays.

C. 120 volt holding coil.

D. Provide pilot light in cover, green type.

E. Provide reset button, and HAND-OFF-AUTOMATIC switch behind lockable cover, field convertible to OFF/AUTO or START/STOP pushbutton.
F. Provide two sets of normally open auxiliary contacts in addition to standard auxiliary holding contacts supplied with each contactor.
G. Provide surface mounted starters in NEMA Type 1 or Type 3 enclosure as required.

2.4 COMBINATION MOTOR STARTERS

A. Provide fused, 3-pole, load break disconnect switches with RK-1 fuses, rotary operating handle, and lock-off facility.
B. Restrict opening of switch enclosure by the use of a defeater screw, unless switch is in the OFF position.
C. Provide contactors with three overload relays.
D. 120 volt holding coil.
E. Provide pilot light in cover, green.
F. Provide reset button, and HAND-OFF-AUTOMATIC switch behind lockable cover, field convertible to OFF/AUTO or START/STOP pushbutton.
G. Provide two sets of normally open auxiliary contacts in addition to standard auxiliary holding contacts supplied with each contactor.
H. Provide control transformer of sufficient capacity to handle operating coil and associated controls.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motor starters as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices complying with applicable requirements of NEC, UL, and NEMA standards.
B. In finished areas, mount motor protection switches flush and install suitable cover plates.
C. Install heaters correlated with full load current of motors provided.
D. Set overload devices to suit motors provided.
E. Install fuses in fusible disconnect switches.
F. Starters furnished as integral parts of factory-assembled, pre-wired equipment shall conform to the above requirements.

3.2 PUSHBUTTON AND SWITCH STATIONS

A. All controllers shall be provided with a heavy-duty type push-button station, rated for 10 amperes continuous load at 600 volt or less.
B. Enclosures shall be general purpose NEMA Type 1, except that pushbutton stations installed outside the building or otherwise exposed to the weather shall be NEMA Type 3R, dust and weather tight. NEMA Type 4 enclosures shall be provided for surface mounting, except as otherwise indicated.
C. Pushbutton stations for non-interlocking contactors shall be momentary contact type with start button, stop button, and red indicator light. Where required for delayed "seal-in" or where otherwise noted.

END OF SECTION

SECTION 264100
LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 CODES AND STANDARDS

A. The following specifications and standards of the latest issue form a part of this specification.

1. Lightning Protection Institute Installation Standard, LPI 175
2. Underwriters Laboratories, Inc. Installation Requirements, LPI 175
3. National Electrical Code (NEC)
4. National Fire Protection Association Lightning Protection Code, NFPA 780

B. All materials tested by Underwriter's Laboratories shall bear their labels A, B and C for materials and installation.

1.4 SCOPE

A. Provide a complete lightning protection system to include the existing facility as well as the addition.

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. The lightning protection system shall conform to the requirements and standards for lightning protection systems of the LPI, UL, NFPA, and NEC. Upon completion, application shall be made to the Underwriters Laboratories, Inc. for inspection and certification. In addition, the Lightning Protection Institute certified system shall be delivered to the owner ensuring that the concealed components have also been monitored during job progress.

D. The system to be furnished under this specification shall be the standard product of manufacturers regularly engaged in the production of lightning protection equipment and shall be the manufacturer's latest approved design. The equipment shall be UL listed and properly UL labeled.

1.6 SUBMITTALS

A. Product Data - Submit manufacturer's data on lightning protection systems and components.

B. Shop Drawings - Submit dimensioned layout drawings of lightning protection system equipment and components, including conductor routing and connections.

C. UL Certificate - Provide Owner with UL Master Label for overall system which is suitable for fastening to building for display. Comply with UL 96A, "Master Labeled Lightning Protection Systems."

PART 2 - PRODUCT

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer - Subject to compliance with requirements, provide lightning protection components of one of the following (for each type of component):

1. Advanced Lightning Technology
2. East Coast Lightning Equipment
3. Harger Lightning Protection
4. Robbins Lightning Protection
5. Thompson Lightning Protection, Inc

2.2 LIGHTNING PROTECTION SYSTEM COMPONENTS

A. Standard - All equipment used this installation shall be UL listed and properly labeled. All equipment shall be new, and of a design and construction to suit the application where it is used in accordance with accepted industry standards and LPI, UL, NFPA, and NEC code requirements.

B. Lighting Protection Equipment - All materials shall be copper and bronze and of the size, weight, and construction to suit the application and used in accordance with LPI, UL, and NFPA code requirements. Class 1 components may be utilized on roof levels 75 feet and below in height. Class II size components are required for roof levels over 75 feet in height. Bolt type connectors and splicers shall be utilized on Class I and Class II structures. Pressure squeeze clamps are not acceptable. All mounting hardware shall be stainless steel to prevent corrosion.

C. Aluminum Components - Aluminum materials may not be used except on roof that utilize aluminum roofing components. On aluminum metal roofs or where aluminum parapet caps exist, the entire roof lightning protection equipment shall utilize aluminum components to insure compatibility. However, the downleads and grounding are to utilize copper with the bimetal transition occurring at the through roof assembly with and approved bimetal through roof assembly. Lead coating is not acceptable as a bimetal transition.

D. Materials below grade to 18" above grade: Copper, except ground rods to be stainless steel.

E. Air Terminals:
   1. Point: Solid copper, 12" Height x 3/8" diameter, coordinate.

F. Fasteners and Attachments: Same material as air terminals.

G. Main Conductors: Copper cable, minimum weight 187.5 lbs/1,000 ft; minimum wire size No.17 AWAG (Class I)

H. Secondary Conductors: Copper cable minimum 13 strand No. 17 AWG.

I. Fasteners:
   1. Same material as conductor.
   2. Galvanized fasteners not acceptable.

J. Connectors and Disconnectors
   1. Compression type designed to withstand 2000 lbs. pull.
   2. Exothermic Welding Type, below grade and in non-accessible areas.

K. Ground Electrodes: 10 ft. stainless steel rods 3/4" diameter.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The installation shall be accomplished by an experienced installation company that is a UL listed, a member of the Lightning Protection Institute, United Lightning Protection Association qualified and an employer of Certified Master Installers of lightning protection systems. A Certified Master Installer shall directly supervise the work.

B. All equipment shall be installed in a neat, workmanlike manner. The system shall consist of a complete conductor network on the roof and include air terminals, connectors, splicers, bonds, copper downleads, and proper terminals.

C. Air Terminals: Install in plumb position securely fastened to withstand overturning.

D. Conductors:
   1. Fastening:
      a) Fasten conductors to building at 3 feet maximum intervals.
      b) On masonry, set fasteners in brick, block or stone, but not in mortar

joints.

E. Conductor Runs:
   1. Bend to radii greater than 8 inches.
   2. Limit angle of turns to 90 degrees.
   3. Route horizontal conductors around obstructions in horizontal plane.
   4. Route connectors in horizontal or vertical planes only.

F. Connect conductor to metal bodies of inductance located within 6 feet by secondary conductor.

G. Ground: Extend minimum of 10 ft into earth.

3.2 COORDINATE

A. The lightning protection installer will work with other trades to insure a correct, neat and unobtrusive installation.

B. It shall be the responsibility of the lightning protection installer to assure a sound bond to the main water service and to assure interconnection with other ground systems.

C. Install approved arresters on power service.

3.3 COMPLETION

A. Upon completion of the installation, the lightning protection installer shall secure and deliver to the Owner the Underwriters Laboratories, Inc. Master Label certification and the Lightning Protection Institute Certified System certification. The system will not be accepted without the UL Master Label plate and the LPI certificate.

3.4 PERSONNEL TRAINING

A. Building Maintenance Personnel Training- Train Owner's building maintenance personnel in procedures for testing and determining resistance-to-ground values of lightning protection system.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 264313
TRANSIENT VOLTAGE SURGE SUPPRESSION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications Sections, apply to this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment, materials, labor, supervision, and services necessary for or incidental to the installation of transient voltage surge suppression as specified.

B. Provide TVSS at the following equipment:

1. Main switchboard
2. Lighting and receptacle branch circuit panelboards

1.4 SUBMITTALS

A. Reference Division 01 and Section 26 0500 for detailed requirements.

B. Product Data: For each type of product indicated. Include operating voltage, rated capacities, operating temperature, shipping and installed weights, and items per Section 2: Products.

C. Product Certifications: Signed by manufacturers of transient voltage suppression devices, certifying that products furnished comply with the following testing and labeling requirements:

1. UL 1449, 2nd Edition listing and classifications.

D. Field Test Reports. Written reports of tests specified in Part 3 of this Section. Include the following:

1. Test procedures used
2. Test results that comply with requirements
3. Failed test results and corrective action taken to achieve requirements

E. Maintenance Data: Transient voltage suppression devices to include installation instructions, operation and maintenance manuals specified in Division 01.

1.5 QUALITY ASSURANCE

A. Product must be made by a company engaged in the manufacture of such devices in the USA for a minimum of ten years.

B. Source Limitations: Obtain suppression devices from a single manufacturer.

C. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Other manufacturers' products complying with requirements may be considered by the engineer/architect if submitted more than 14 days prior to bid. Samples may be required for approval. Refer to Division 01 Section "Substitutions".

D. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. IEEE Compliance: Comply with ANSI/IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits" and test devices in accordance with ANSI/IEEE C62.45, "IEEE Guide for Surge Suppressor Testing".

F. NEMA Compliance: Comply with NEMA LS-1 "Low Voltage Surge Protective Devices".

G. UL Compliance: Listed to UL 1449, 2nd Edition "Transient Voltage Surge Suppressors".

1.6 PROJECT CONDITIONS

A. Placing into Service: Do not energize or connect service entrance equipment or panelboards to their sources until the surge protective devices are installed and connected. Do not single phase, hi-pot or meggar Service Entrance Equipment without disconnecting the surge protective device, as damage may result from these procedures to the surge protective device.

B. Service Conditions: Rate surge protective devices for continuous operation under the following conditions, unless otherwise indicated:
   1. Maximum Continuous Operating Voltage: Not less than 125 % of nominal system operating voltage for 120/208 VAC Wye systems, Not less than 115 % for 277/480 VAC Wye or 480 VAC Delta systems.
   2. Operating Temperature: -40 to +185 ºF (-40 to +85 ºC)
   3. Humidity: 0 to 95 %, non-condensing.
   4. Altitude: Less than 20,000 feet (6,000 m) above sea level.

1.7 COORDINATION

A. Coordinate location of field mounted surge suppressors to allow adequate clearances for maintenance, clearance per NEC and all local electrical codes.

1.8 WARRANTY

A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of surge suppressors that fail in materials or workmanship within the following period:
   1. Ten years (120 months) from date of Substantial Completion, or 126 months from date of manufacture for the PG4000 and EH models.
   2. Warranty shall include parts and labor.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements of this specification listed herein, provide products by one of the following manufacturers:
   1. LEA International
   2. Intermatic, Inc
   3. Thor Systems

B. This specification is performance based, and any other vendors who desire approval to bid this project shall provide written documentation of any deviations from this specification, which shall be included in product submittal 7 days prior to bid.

2.2 SERVICE ENTRANCE TYPE SURGE SUPPRESSION

A. Surge Protective Device Description: With the following features and accessories:
   1. LED indicator lights for power and protective status.
   2. Utilizing metal oxide varistor technology.
   3. Integral EMI/RFI Filter providing up to 54 dB of attenuation from 20 kHz to 100 MHz.
   4. Internal surge rated fuses with a 200 kA interrupting capacity.
   5. Internal 200 KA (8 x 20 usec) surge rated safety-interlocked disconnect.
   6. Including thermal protection for each component, which is continuously monitored.
   7. Internal surge module easily replaceable.
   8. Integral Form C Contacts for remote indication of suppression status via connection to building management system (BMS provided by others).
   9. Integral Audible Alarm with silence switch.
   10. Integral Surge Counter that records surges suppressed in all modes.
   11. NEMA 1R/3R style enclosure suitable for indoor/outdoor installation.

B. Single Impulse Surge Current Capacity shall be as follows:

System Configuration	Line to Neutral	Line to Ground	Line to Line	Neutral to Ground
120/240 Volt Single Phase	125 KA	125 KA	125 KA	125 KA
120/208 Volt Three Phase Wye	125 KA	125 KA	125 KA	125 KA
120/240 Volt High Leg Delta	125 KA	125 KA	125 KA	125 KA
277/480 Volt Three Phase Wye	125 KA	125 KA	125 KA	125 KA
480 Volt Three Phase Delta	N/A	125 KA	125 KA	N/A
347/600 Volt Three Phase Wye	125 KA	125 KA	125 KA	125 KA
600 Volt Three Phase Delta	N/A	125 KA	125 KA	N/A

C. UL 1449 (6KV, 500 Amp) let-through voltages as follows:

Mode	120/240 Volt Single Phase	120/208 Volt Wye	120/240 Volt High Leg Delta	277/480 Volt Wye	480 Volt Delta	347/600 Volt Wye	600 Volt Delta
L-N	460 V	460 V	460 V / 632 V	873 V	N/a	1,084 V	N/a
L-G	480 V	480 V	480 V / 664 V	857 V	1,330 V	1,132 V	1,777 V
N-G	512 V	512 V	512 V	774 V	N/a	979 V	N/a
L-L	763 V	763 V	935 V	1,523 V	1,317 V	1,936 V	1,837 V

2.3 PANELBOARD TYPE SURGE SUPPRESSION

A. Surge Protective Device Description: With the following features and accessories:
1. LED indicator lights for power and protective status.
2. Utilizing metal oxide varistor technology.
3. Internal surge rated fuses with a 200 KA interrupting capacity.
4. Including thermal protection for each component, which is continuously monitored.
5. NEMA 1 style enclosure suitable for indoor installation.
6. Flush mounting plate available for flush mount installations.

B. Single Impulse Surge Current Capacity shall be as follows:

System Configuration	Line to Neutral	Line to Ground	Line to Line	Neutral to Ground
120 Volt Single Phase	26 KA	26 KA	N/A	26 kA
120/240 Volt Single Phase	26 KA	26 KA	26 KA	26 KA
120/208 Volt Three Phase Wye	26 KA	26 KA	26 KA	26 KA
120/240 Volt High Leg Delta	26 KA	26 KA	26 KA	26 KA
277/480 Volt Three Phase Wye	26 KA	26 KA	26 KA	26 KA
480 Volt Three Phase Delta	N/A	52 KA	26 KA	N/A

C. UL 1449 (6KV, 500 Amp) let-through voltages as follows:

Mode	120 Volt Single Phase	120/240 Volt Single Phase	120/208 Volt Wye	120/240 Volt HLD	277/480 Volt Wye	480 Volt Delta
L-N	419 V	376 V	392 V	392 V / 627 V	791 V	N/a
L-G	435 V	389 V	385 V	385 V / 635 V	775 V	1,194 V
N-G	416 V	365 V	375 V	373 V	396 V	N/a
L-L	N/A	635 V	644 V	661 V	1,240 V	1,247 V

PART 3 – EXECUTION

3.1 INSTALLATION OF SURGE PROTECTIVE DEVICES

A. Install devices at switchboards, distribution panels, and panelboards.

B. Provide multi-pole, 60 Amp breaker as a dedicated disconnect for the suppressor at the Main Switchboards.

C. Install devices per manufacturer's instructions with conductors between suppressor and points of attachment as short and as straight as possible. Do not mount internal to switchgear.

D. Provide multi-pole, 30 Amp breaker as a dedicated disconnect for the suppressor at panelboard locations.

3.2 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality control testing:

1. After installing the surge protective devices, but before electrical circuitry has been energized, test for compliance with requirements.
2. Complete start-up checks and voltage verifications according to manufacturer's written instructions.
3. Perform visual and mechanical inspection on each unit. Certify that units are installed per manufacturer's recommendations.

B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

END OF SECTION

SECTION 265000
LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions, apply to work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Division 26.

B. All other Divisions of the Contract Documents. Refer to each Division's specifications and drawings for all requirements.

1.3 SCOPE

A. Provided all equipment, materials, labor supervision, and services necessary for or incidental to the installation of all lighting fixtures as indicated on the drawings, and as specified.

B. Work included:

1. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and all accessories.
2. Lighting fixtures shall be furnished as scheduled on the drawings and as specified herein.
3. Interior lighting shall be controlled via a digital lighting control system. Refer to Section 265900. Exterior lighting shall be controlled via a time clock or photo cell (and exterior lighting contactor(s)).

1.4 SUBMITTALS AND SHOP DRAWINGS

A. General: Submit in accordance with Division 01 Submittals Section and Section 260500 for detailed requirements.

B. Product Data: Submit manufacturer's catalog cut sheets, data sheets and installation instructions for all light fixtures, lamps and ballasts arranged in order of fixture designation.

C. Incomplete submittals will be returned, un-reviewed. Include data on features, accessories, and the following:

1. Dimensions of fixtures
2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data
3. Emergency lighting unit battery and charger
4. Fluorescent and high-intensity-discharge (HID) ballasts
5. Types of lamps

D. Samples for Verification: For lighting fixtures designated for sample submission in the Interior Lighting Fixture Schedule or for accepted substitutions as noted.

1. Lamps: Specified units installed
2. Ballast: 120-V model of specified ballast type

1.5 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Provide the manufacturer's certificates that confirm that materials meet or exceed minimum requirements as specified.

D. Standards: Comply with applicable NEMA, IEEE, UL and NFPA Standards.

E. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Fixture lamps shall be furnished as scheduled and as specified.

B. Each fixture shall be complete with its appropriate hardware, finish trim and appurtenances as required for a finished installation. Provide full complement of lamps for each fixture.

C. All fluorescent sockets shall be spaced properly to allow for correct fit, and contacts shall be silver plated, edge-wiped type.

D. Fixtures shall be free from light leaks, exposed screws and pointed projections, sharp edges, scarred, marred, and scratched finishes.

2.2 LAMPS

A. Provide all lamps for all lighting fixtures. Types are specified in the lighting fixture schedule. Use incandescent lamps rated for 130-volt service unless otherwise indicated. Where metal halide lamps are specified in open fixtures, only those lamps designated by ANSI as Type "O" shall be provided. ANSI Type "S" lamps are not acceptable. Where specific lamp product numbers are included in the lighting fixture schedule, equivalent products from other acceptable manufacturers may be used, only if approved by the corresponding fixture manufacturer and the Engineer. Acceptable lamp manufacturers include Osram/Sylvania, Philips, General Electric, Venture, Ushio and Westinghouse

B. All lamps shall be free from defects in manufacturer and covered by an implied warranty based on lamp mortality data as such that defective lamps or lamps failing at a higher than normal rate shall be replaced after factory inspection determining cause of failure or defect.

C. General Requirements: Unless otherwise indicated, features include the following:

1. Designed for type and quantity of lamps indicated at full light output and lamp life.
2. Total Harmonic Distortion Rating: Less than 20 percent.
3. Sound Rating: A.
4. Ballasts for lamps of T5, T4, or T2 diameter shall contain dynamic end-of- lamp life sensing circuitry.
5. Coordinate lamp and ballast compatibility with manufacturers.

2.3 FLUORESCENT BALLASTS

A. General. Provide lighting fixture ballasts as required for proper operation of the lamps specified for each fixture type.

B. Fluorescent: Provide fixtures with Class P ballasts with power factor greater than 0.95 and Class A sound ratings. Provide fully electronic instant start ballasts for T8 and compact fluorescent lamps. Provide ballasts with ballast factors greater than 0.95, crest factor less than 1.7, FCC Class A compliance for RFI/EMI, and total harmonic distortion less than 20 percent. Use ballasts tested or approved by Electrical Testing Laboratories and Certified Ballast Manufacturers. Fluorescent ballasts for exterior use shall be rated to start reliably at temperatures as low as 32 ºF. Ballasts for lamps T5, T4, or T2 diameter shall contain dynamic end-of-lamp life sensing circuitry. Acceptable manufacturers of fluorescent ballasts are Advance, and Osram/Sylvania.

C. Metal Halide (HID). Provide constant wattage pulse start ballasts with high power factor. Ballasts must be suitable for operation in ambient temperatures from - 20°C through 55°C. Acceptable manufacturers of HID ballasts are Osram/Sylvania, Advance, Valmont, and the listed lighting fixture manufacturers.

D. Where applicable, ballasts shall meet minimum efficacy standards of Public Law No. 100-537, National Appliance Energy Conservation Amendments of 1988.

E. Ballast shall withstand line transients as defined in ANSI/EEE C62.41, Category A.

F. Ballast case temperature shall not exceed 25°C temperature rise over 40°C ambient.

G. Ballast shall have a frequency of operation of 20 kHz or greater, and operate without visible flicker.

H. Ballast shall have a power factor of 90% or above.

I. Ballast shall not contain polychlorinated biphenyls (PCB's).

J. Ballast shall meet the requirements of the Federal Communications Commission Rules and Regulations, Part 18, Class A.

2.4 RECESSED LUMINAIRES

A. Recessed Incandescent Luminaires: Prewired type with junction box forming an integral part of the assembly.

B. Supply recessed luminaire complete with trim type required for ceiling system installed. Before ordering, confirm ceiling construction details and architectural finish for each area.

2.5 SPARE PARTS

A. Provide 10% spare lamps and ballasts, for each type of lamp and ballast scheduled for the project. Deliver these spare devices to the Owner's attic stock, as directed.

2.6. LENS

A. Lenses for fluorescent fixtures shall be 100% virgin acrylic and have a minimum thickness of 0.125 inch, nominal unless otherwise noted.

PART 3 - EXECUTION

3.1 INDOOR LIGHTING FIXTURES

A. Install a lighting fixture for each and every lighting outlet indicated. Should any designation be omitted, the fixture shall be the same type as used for areas of similar usage.

B. Adequately support each fixture; minimum safety factor shall be 2. Use galvanized steel hardware unless other means of support is shown.

3.2 SUPPORTS

A. Refer to Section 260529.

B. Support fluorescent luminaires directly from building structure by rod hangers and inserts or metal angle headers supported from framing structure of ceiling suspension system.

C. Support luminaires more than 2 ft. long by four hangers per luminaire minimum, independent of ceiling structure or T-Bars.

3.3 RECESSED LUMINAIRES

A. Recessed fixtures mounted in suspended ceiling with exposed T-bar grid system shall be supported from the structure above and be clamped to the ceiling T-bar grid structure and secured thereto to prevent unauthorized access to the ceiling space.

3.4 WIRING METHODS

A. Wiring methods shall be suitable for an inaccessible ceiling space. Reference NEC Article 370-29.

3.5 ADJUSTING AND CLEANING

A. Prior to final acceptance, thoroughly clean all fixtures, inside and out, including plastics and glassware. Adjust all trim to properly fit adjacent surface, replace broken or damaged parts and lamps. Test all fixtures for proper operation.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 26 5090
DIGITAL NETWORK CONTROL SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 specification Sections.

B. All contract documents and addenda.

1.2 SUMMARY

A. Section Includes:

1. Digital network control system.

B. Contractor responsibilities:

2. Coordinate, receive, mount, connect, and place into operation all equipment. Furnish all conduit, wire, connectors, hardware, and other incidental items necessary for the complete and properly functioning relay control system as described herein and shown on the plans.

C. The digital network control system shall control:

a. Facility lighting (addition only) for each room individually

b. Exterior lighting

c. Blind control for 8 motorized window blinds in Training Room (including local control panel)

d. One motorized (up/down) projector screen. Include control in same panel as c. above

e. One motorized (up/down) window safety grille

f. Cut-off valves to control gas flow to BBQ grill and stove/oven with local manual reset push buttons

1.3 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE)

B. C62.41-1991 - Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

C. ASTM International (ASTM)

1. D4674 -02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight

D. International Electrotechnical Commission

1. (IEC) 801-2 Electrostatic Discharge Testing Standard

2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations - electronic switches

E. International Organization for Standardization (ISO)

1. 9001:2000 - Quality Management Systems.

F. National Electrical Manufacturers Association (NEMA) WD1 (R2005) - General Color Requirements for Wiring Devices.

G. Underwriters Laboratories, Inc. (UL):

1. 508 (1999) - Standard for Industrial Control Equipment. As referenced in Article 1.3.H, Paragraph 1, if ballasted loads are or will be controlled by any relay cabinet on this project, all cabinets must carry a UL listing that directly addresses ballasted loads. If ballasted loads are controlled, cabinets which bear only a UL916 listing should not be acceptable on this project.

H. American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE)

1. ASHRAE 90.1

1.4 SUBMITTALS

A. General

1. Submit in accordance with Conditions of the Contract.

B. Bill of Materials: Complete list of all parts needed to fully install selected system components.

C. Specification Conformance Document: Indicate whether the submitted equipment:

1. Meets specification exactly as stated.

2. Meets specification via an alternate means and indicate the specific methodology used.

D. Shop Drawings: shall be submitted for approval within 30 days following receipt of contract. No equipment shall be fabricated prior to approval of these drawings, which shall detail all mechanical and electrical equipment, including:
   1. One-line diagrams
   2. Internal wiring
   3. Wire counts
   4. Physical dimensions of each item.

E. Product Data: Product data sheets with performance specifications demonstrating compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions.

1.5 CLOSEOUT SUBMITTALS

A. To be provided within two weeks following system turn-on.
   1. Warranty documents specified herein.
   2. Three sets of operation and maintenance manuals.
   3. Two complete sets of as-built drawings

1.6 QUALITY ASSURANCE

A. Manufacturer Requirements
   1. Continuously engaged in the manufacture of architectural controls and relays for no less than ten years.
   2. Provide factory-direct technical support hotline 24 hours per day, 7 days per week.
   3. Maintain a quality system that is registered to the ISO 9001:2000 Quality Standard.

B. Control system components:
   1. Listed by UL specifically for the required loads, or certified by recognized independent testing organizations that test to UL standards.
      a. UL508
         1) UL916 listing not acceptable.
   2. Comply with ASHRAE 90.1
   3. Comply with CEC Title 24

C. Relay cabinet enclosures
   1. NEMA 1 rating
   2. NEMA 3R rating

D. Installer Qualifications
   1. Experienced in performing the work of this section
   2. Has specialized in installation of work similar to that required for this project.

E. Source Limitations
   1. To assure compatibility, obtain all system components from a single source with complete responsibility for all controls and accessories specified in this Section and elsewhere in Division 26. The use of subcontracted component assemblers is not acceptable.

1.7 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

A. Fluorescent Ballasts
   1. Supply ballasts that are compatible with the network control system.
   2. Accept 0 – 10V dimming control.

B. All conduit, wire, connectors, hardware, and other incidental items necessary for the complete and properly functioning network control system as described herein and shown on the plans.

1.8 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery:
   1. Deliver materials in manufacturer's original, unopened, undamaged packages with intact identification labels.
   2. Deliver to other trades in a timely manner.

D. Storage and Protection: Store materials away from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.9 PROJECT CONDITIONS

A. Do not install equipment until the following conditions can be maintained in spaces to receive equipment:
   1. Ambient temperature: 0° to 50° C (32° to 122° F).
   2. Relative humidity: Maximum 90%, non-condensing.
   3. Control system must be protected from dust during installation.

1.10 WARRANTY

A. Manufacturer's Warranty
   1. Warrant all equipment free of defects in materials and workmanship.
   2. Warranty Period:
      a. Warrant all system components for 24 months from date of turn-on.
      b. Make extended warranties available.
   3. Warrant relay modules for a period of 10 years.
      a. Provide replacement modules at no cost to Owner.
   4. Owner's Rights: Manufacturer's warranty is in addition to, not a limitation of, other rights the Owner may have under contract documents.

1.11 COMMISSIONING

A. The Contractor shall provide a fully tested and functional system to the Owner. The Contractor shall, at no cost to the Owner, remedy any and all defects before turning the system over to the Owner.

B. Turn-On: Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, Manufacturer's Certified Technician shall completely check the installation prior to energizing the system. Each installed relay system shall be tested for proper ON/OFF operations, and proper LED illumination. Each installed control cabinet shall be tested verifying that each controlled load adjusts to the selected setting and that all switch LED's illuminate properly.

C. At the time of checkout and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

1.12 MAINTENANCE

A. Enable the end user to order new equipment for system expansion, replacements, and spare parts.

B. Make new replacement parts available for a minimum of ten years from the date of manufacture.

C. Provide factory-direct technical support hotline 24 hours per day, 7 days per week.

D. Offer renewable annual service contracts, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system commissioning.

PART 2PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of design product: Leviton Manufacturing Co. Inc. GreenMAX or subject to compliance and prior approval with specified requirements of this section, one of the following:
   1. Leviton Manufacturing Co. Inc. GreenMAX
   2. Lutron
   3. Douglas Lighting Controls
   4. Marlin Controls

B. Substitutions:
   1. Show all substitutions as an add or deduct from the base bid price
   2. Clearly delineate all proposed substitutions as such and submit in writing for approval by the design professional a minimum of 10 working days prior to the bid date.
   3. Proposed substitutions must be made available to all bidders.
   4. Proposed substitutes must be accompanied by a review of the specification noting compliance on a line-by-line basis.
   5. Prior to rough-in, provide complete engineered shop drawings, including power wiring, with deviations from the original design highlighted in an alternate color, to the engineer for review and approval.

6. By using pre-approved substitutions, the contractor accepts responsibility and associated costs for all required modifications to circuitry, devices, and wiring.

C. Substitutions that affect the energy conservation capability of the completed project or its ability to meet overall energy conservation targets to be fully detailed and coordinated with other relevant sections of the specification.

2.2 DESCRIPTION

A. Digital network control system:
1. Configurable relay cabinets
2. Remote low voltage input cabinets
3. Digital switches
4. Low voltage control devices
5. Latching, Return to Closed (RTC) Latching and dimming / switching relay modules
6. Distributed scheduling functions
   a. Cabinets continue to operate on last established schedule in the event of a network malfunction
   b. Network interruption alarm is displayed on the remote computer connected to Internet (if required)

B. Relay Insert Panel provides data bus and data intercommunication between all Relay Modules and Command Module.

C. Integral power supply for Command Module, Relay Insert Panel and other accessories.
1. 70W (2.9 amperes) output at +24VDC.

D. System programming and firmware upgrades
1. Local
   a. Uploaded via USB 2.0 ports on Command Module
      1) System software can be stored on a Flash memory stick or thumb drive
   b. Automated process upgrades entire system once operator initiates the update sequence.
   c. Automated system can upgrade firmware to specific devices or all system components at one time, as selected by the user.
      1) All devices can be upgraded from a single system connection point and location.
2. Remote via Internet
   a. Uploaded to Command Module
      1) Requires Owner-provided Ethernet connection to Internet with static IP address.
      2) Entire system to require only one Internet address and connection.
   b. Upgrade procedure to be initiated by Owner and managed by the Command Module.
   c. Automated system
      1) Allows user to select specific devices or all system devices for firmware upgrades.

2.3 PERFORMANCE CRITERIA

A. Emergency Operation — overrides all other control inputs.

B. Daylight Harvesting — allows interior and/or exterior photocells to dim lights and/or ballasts and/or turn them on or off.

C. Occupancy Sensing — interface with occupancy sensors in spaces where they are utilized.

D. Manual On/Auto Off — An occupant must manually turn lights on, but the occupancy sensor automatically turns lights off when the space is unoccupied.

E. Auto On/Auto Off — the occupancy sensor automatically turns lights on and off without the need of a switch.

F. Power failure recovery — All devices return to their previous status prior to power loss.

2.4 NETWORK PROTOCOLS

A. LumaCAN
1. Daisy chain topology
2. Maximum branch length of 1600 feet

a. Devices located at branch ends must have their termination jumpers in the ON position.

B. Ethernet
1. Command Modules only
2. Can be configured as a bridge between LumaCAN branches
3. Can be used as an Internet connection
a. Remote firmware upgrades, monitoring and programming possible via Internet
4. Ethernet switches can be used to extend system coverage area by linking Command Modules

C. BACnet IP
1. Support all 16 BACnet priorities
2. Separate Priority Array for each relay
3. 1 is highest, 16 is lowest
4. Higher priority maintains control until a “relinquish” command is issued
5. Top three priority levels permanently assigned to Internal Main Bypass, Emergency Power and Internal Relay Bypass
6. Individual control of all other priorities

D. Support 252 Analog / Binary Outputs

E. Support 240 Analog / Binary Inputs

2.5 NETWORK CABLE

A. LumaCAN: Cat 6

B. Ethernet: Cat 5 or better

C. BACnet IP: Cat 5 or better

D. Terminations: RJ-45 connectors

2.6 SYSTEM PROGRAMMING

A. Relay Operation
1. Configure pulsed output
a. Vary duration of relay closure from one (1) to sixty seconds (60).
2. Configure Blink Warn
a. Allow definition of Blink length and interval for each relay
1) System to ship with default settings.
3. Return to Closed functionality
4. Enable/disable zero-cross technology
5. Assign relay to a group
a. System shall have the ability to assign relays to control groups.

B. Photocell control
1. Open or closed loop operation
2. Eight (8) independent pairs of rising and falling trigger point values per photocell input.
3. Delay times of thirty (30) seconds to thirty (30) minutes
4. ON/OFF behavior
a. Auto ON with Manual Override
b. Blink Warn Sequence

C. Occupancy Sensor configuration
1. Control eight (8) relays or one (1) group of relays
2. Allow programming of each relay or group with the following operational behaviors:
a. Auto ON/ Auto OFF
1) Occupancy detection signal closes the assigned relays or groups (turns lights ON)
2) Vacancy detection signal opens the assigned relays or groups (turns lights OFF) after a programmed light hold (delay) time has expired
b. Auto ON/Auto OFF with light hold off
c. Manual ON/Auto OFF with light hold off
d. Manual ON/Auto OFF

e. Manual ON/Manual OFF
f. Manual ON/Manual OFF with light hold off

3. Set Light Hold (delay) Times from thirty (30) seconds to thirty (30) minutes

D. Emergency Input configuration
1. Allow user to program each individual relay's response to Emergency signal

E. Low voltage switches
1. Program delay time within each area or zone
a. Thirty (30) seconds to thirty (30) minutes
2. Select button type
a. Momentary or maintained
3. Select switch station type
a. Single button operation or dedicated ON and OFF buttons
4. Assign each switch to individual relays or groups

F. Digital switches
1. Program delay time within each area or zone
a. Thirty (30) seconds to thirty (30) minutes
2. Assign each switch to individual relays or groups

G. Native BACnet-compatible scheduling objects

H. System Time Clock
1. Coordinate the operation of all system components.
2. Able to continue execution of scheduled operations if the network connection is lost.
3. Time and date
a. Manual controls
b. Programmable to automatically respond to Network Time Protocol (NTP) when connected to the Internet.

I. Scheduling
1. Relay or group ON at specific time
2. Relay or group ON at specific time with light hold off
a. Thirty (30) seconds to thirty (30) minutes
3. Relay or group OFF at specific time
4. Daily Agendas
a. Define an agenda for each 24 hour day.
1) Agenda to include up to twelve (12) transitions for each relay or group
2) Transitions to last one (1) minute or longer.
b. Schedule Agendas to occur:
1) Between specified dates.
2) On a specific date.
3) On a date relative to the current date.
c. Allow user to override an agenda with a new one in real time.
d. Allow user to define Agendas and assign them to relays and / or groups.
5. Calendars
a. Allow programming of up to sixteen (16) Calendars.
1) Each calendar to contain a record of Daily Agendas.

J. Astronomical Clock
1. Allow twelve (12) or twenty-four (24) Hour display formats
2. Allow selection of Automatic Daylight Savings Time adjustment
3. Allow user to enter Latitude data
4. Allow user to program Sunrise/Sunset times with optional offsets

K. Low voltage inputs
1. Compatible with any momentary or maintained switch operating at +24 VDC
2. Compatible with any photocell and/or occupancy sensor requiring +24 VDC power and providing either a dry contact closure or 0 — 10 VDC signal via three-conductor wiring
a. +24 VDC, Com, Signal

1) If +24 VDC is supplied to the device by an external power supply, use two-wire Com and Signal configuration

2.7 RELAY CABINETS

A. Command Modules, Remote Input Modules and Relay Modules to be installed in the field without voiding UL listing.

B. Performance Criteria

1. Capacities
   a. Eight (8), sixteen (16), thirty-two (32) or forty-eight (48) single- or dual-pole relays.
   b. Optional Factory Installed Low Voltage Input cards
      1) Eight (8) or sixteen (16) inputs
2. Physical
   a. Removable locking hinged door.
      1) Removing the door from its hinges shall not defeat the locking mechanism.
   b. Able to be delivered empty of electronics
      1) To facilitate handling, rough-in, preliminary wiring and flexible project scheduling.
   c. Rear panel to have both key-hole mounting slots and round clearance holes
   d. Cabinet sidewalls to be clear of knockouts or other obstacles to allow custom conduit layout patterns.
   e. Ventilated covers and bottom panel
   f. NEMA1 cabinet to provide cooling to circuit conductors without the use of any moving parts such as a fan.
   g. Circuit wiring concealed by covers that provide maximum arc flash protection
      1) Low-voltage electronics can be serviced without Personal Protective Equipment
      2) Low voltage and high voltage compartments to be separated for optimal safety.
      3) Covers to be easily removed and replaced.
3. Electrical
   a. Relays shall be rated to switch voltages from 24 to 277VAC and +24VDC.
   b. Short Circuit Current Rating (SCCR) of the assembled cabinet, regardless of its specific configuration, to be 25,000 Amperes at 277VAC.

C. Physical

1. Material
   a. Steel
2. Relay Insert Panel
   a. Allow relays modules to be installed, removed and relocated without internal rewiring or mounting screws
3. Grounding points
   a. Cabinet to provide bonding location for the Command Module in the upper left wire-way
   b. Cabinet to provide grounding location consisting of two threaded screw holes at bottom of enclosure
      1) Hole spacing to allow use of typical equipment ground bus-bars in place of screws
      2) Cabinet to include a green grounding screw as a designated grounding point

2.8 COMMAND MODULES

A. Description

1. Field-installable and/or replaceable self-contained units with emergency input.
2. Integral overload and short circuit protection.

a. Provides separate overload protection for:
1) System processor
2) LumaCAN devices including the Low Voltage Input card.

3. Supplies power to all electronics in the Relay Cabinet
4. Supplies power to digital switches via LumaCAN
5. Can supply +24 VDC to other low-voltage inputs
6. Can contain an optional Low Voltage Input (+24VDC) card suitable for termination of eight (8) or sixteen (16) low voltage inputs.

B. Emergency Signal Input
1. Input for a hardwired emergency override signal
a. Requires external contacts
b. Activates Emergency status when a signal of +24VDC is present
c. Releases Emergency status when signal falls to zero (0VDC).
2. Controls all relays as assigned by the user regardless of processor operation.
3. Provides +24VDC to external contacts

C. Low Voltage Input Card Option
1. Allows user to configure inputs
a. 0 – 10VDC analog
b. +24VDC switched
c. Contact closure.
2. +24 VDC power supply
a. 70W (2.9 amperes) capacity
b. Input devices can use external power supplies
3. Compatible with the following devices
a. Occupancy sensors
b. Photocells
c. GE switches
d. External Contacts
e. Multi-button low voltage switches
f. ON/OFF dedicated button low voltage switches

D. Controls
1. High Resolution Color Graphic Display Screen
2. LED Status Indicators
a. Individual Relays
1) Manual Actuator indicating ON/OFF state
b. Microprocessor Online
c. Ethernet Link
d. Relay Communication
e. +5 VDC Power Supply Normal Operation
f. LumaCAN communication

E. Electrical
1. Grounding point provided in left wire-way

F. Physical
1. Can be tilted forward for easy access to digital connection points without removal from relay cabinet.

2.9 REMOTE LOW VOLTAGE INPUT CABINETS

A. Fully functional as independent LumaCAN network nodes
1. Can be connect to network at any location: direct dedicated connection to a Relay Cabinet is not required

B. Eight (8) or sixteen (16) Low Voltage inputs

C. Provides power to LumaCAN digital devices

D. Integrated power supply
1. Supply 100 – 277VAC
2. Rated output at 70W of +24 VDC power via LumaCAN
3. Connected devices can be self-powered.

E. Input types
1. Occupancy sensors

2. Photocells
3. Contact closures
4. Low Voltage switches

2.10 RELAY MODULES

A. Single Pole, Latching Relay
   1. Supported and listed loads
      a. 24-277VAC, 20A Tungsten Halogen Incandescent
      b. 24-277VAC, 30A Ballast
      c. 347VAC, 20A Ballast
      d. 120VAC 1/2hp Motor, 277VAC 1hp Motor, 240VAC 1hp Motor

B. Single Pole, Return To Closed, Latching Relay
   1. Supported and listed loads
      a. 24-277VAC, 20A Tungsten Halogen Incandescent
      b. 24-277VAC, 30A Ballast
      c. 347VAC, 20A Ballast
      d. 120VAC 1/2hp Motor, 277VAC 1hp Motor, 240VAC 1hp Motor

C. Double Pole, Latching Relay
   1. Supported and listed loads
      a. 208/240VAC, 20A Tungsten Halogen Incandescent
      b. 208/240/480VAC, 30A Ballast
      c. 600VAC, 20A Ballast
      d. 208/240VAC 1hp Motor

D. Double Pole, Return To Closed, Latching Relay
   1. Supported and listed loads
      a. 208/240VAC, 20A Tungsten Halogen Incandescent
      b. 208/240/480VAC, 30A Ballast
      c. 600VAC, 20A Ballast
      d. 208/240VAC 1hp Motor

E. Physical
   1. All relay modules to have identical dimensions and occupy a single mounting space, allowing any number of each type to be used in the Relay Insert Panel
   2. Installation and removal via retaining tabs: no screws or internal wiring required
   3. All relays to have manual actuator handles
      a. Allow changing the relay state without tools
      b. Allow controlled circuits to be powered as soon as they are wired, without energized Command Module electronics.
      c. Manual actuator accessible in low voltage compartment only
   4. Supported Wire Sizes
      a. 6 – 14 AWG
      b. Input and output terminals to be freely torque-able to the required specification without risk of damage.
   5. Manufacturer to provide barriers for installation between relays.

F. Electrical
   1. Latching Modules
      a. Electrically held relays are unacceptable due to parasitic power loss
      b. Single-pole and dual-pole modules
      c. SCCR (Short Circuit Current Rating) of 25,000 amps
      d. Available with and without Return to Closed (RTC) function
      e. Compatible with Sentry Switches and AS100 switches
   2. Dimming – Switching Module
      f. All specifications of the Latching Module above apply
      g. Single-pole
      h. Additional 0 – 10VDC control point
         1) Suitable for dimming 0 – 10V fluorescent ballasts
         2) Suitable for dimming LEDs that accept 0 – 10VDC control signals

2.11 DIGITAL SWITCHES

A. Configurations
   1. One (1), two (2), or four (4) buttons
B. Colors
   1. White
   2. Ivory
   3. Light Almond
   4. Gray
C. RJ-45 connectors
   1. LumaCAN input
   2. LumaCAN throughput
D. Custom Engraving
   1. To be available for the following:
      a. Individual buttons
      b. Station wallplates
   2. Engraved characters to be of a contrasting color as shown on drawings

2.12 COMPONENTS
A. Relay Cabinets
B. Relay Modules
C. Remote Low Voltage Input Cabinets
D. Digital Switches
E. Digital Keyswitch
F. Accessories
   1. Occupancy Sensors
   2. Photocells

PART 3 - EXECUTION

3.1 INSTALLATION
A. Coordinate, receive, mount, connect, [and place into operation] all equipment.
B. Install equipment in accordance with manufacturer's installation instructions.
   1. Install relay cabinets in locations where audible noise is acceptable.
C. Provide complete installation of system in accordance with Contract Documents.
D. Maintain performance criteria stated by the manufacturer without defects, damage, or failure.
E. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.
F. Ensure that daylight sensor placement minimizes sensors view of electric light sources; ceiling mounted and fixture-mounted daylight sensors shall not have direct view of luminaries.
G. Furnish all conduit, wire, connectors, hardware, and other incidental items necessary for a properly functioning control and relay system as described herein and shown on the plans. The Electrical Contractor shall maintain performance criteria stated by the manufacturer without defects, damage, or failure.
H. Compliance: Contractor shall comply with manufacturer's product data, including shop drawings, technical bulletins, product catalog installation instructions, and product carton instructions for installation.
I. Circuit Testing: The contractor shall test that all branch load circuits are operational before connecting loads to system load terminals, and then de-energize all circuits before installation.
J. Application of Power: Power shall not be applied to the relay system during construction and prior to turn-on unless specifically authorized by written instructions from the manufacturer.
K. Programming: Program low-voltage and digital switch functionality remotely from the control cabinet.
   1. Terminate and test all network cable assemblies. Each field installed RJ45 connection must be tested prior to system interconnection. A test report must be furnished to factory-certified service engineer prior to scheduling commissioning activity.

3.2 FIELD MEASUREMENTS
A. The electrical contractor shall be responsible for field measurements and coordinating the physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.

3.3 INSPECTION

A. Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.4 SITE PROTECTION

A. Contractor shall protect installed product and finished surfaces from damage during all phases of installation including storage, preparation, testing, and cleanup.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 270528
TELEPHONE RACEWAY SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General and Supplementary Conditions, apply to the Work specified in this Section.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. All other Sections of Divisions 26 and 27.

B. All other Divisions of the Contract Documents. Refer to each Division's Specifications and Drawings for requirements.

1.3 SCOPE

A. Provide all equipment materials, labor, supervision, and services necessary for or incidental to the installation of a completed telephone raceway system as shown or indicated on the drawings and/or as specified.

B. Work Included:

1. Conduit.
2. Outlet boxes.
3. Pull and junction boxes.

1.4 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the Owner, provide such other labor and materials as are required to complete the work of this Section in accordance to the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. When requested, provide the Architect with manufacturer's certificate that materials meet or exceed minimum requirements as specified.

1.5 SYSTEM DESCRIPTION

A. Conduit, terminal boards, and outlets to form empty raceway system.

PART 2 - PRODUCTS

2.1 RACEWAYS

A. Where telephone outlets are shown in plan, provide a single gang box with ¾" EMT to the telephone terminal board complete with nylon pull cord.

B. Make conduit provisions for switching of telephone outlets located within the dorm rooms. The switch panel shall be located in the control room.

PART 3 - EXECUTION

A. Place "TELEPHONE" label on pull and junction boxes.

B. Provide a nylon pull cord in each telephone conduit run.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 31 1000
SITE CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 SUMMARY

This section includes

A. Preparation for work.
B. Protection of existing trees indicated to remain.
C. Clearing and grubbing.
D. Debris removal.
E. Erosion control.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.1 GENERAL

A. Site clearing and grubbing shall consist of the removal and disposal of trees, stumps, brush, roots, vegetation, logs, rubbish, and other objectionable matter from the construction area.

3.2 PREPARATION FOR WORK

A. Verify that existing plant life designated to remain, if any, is tagged or identified, and protected as described in the Specifications.
B. Verify and protect survey control.

3.3 PROTECTION OF EXISTING FEATURES

A. Locate, identify, and protect from damage utilities to remain.
B. Protect trees, plant growth, and features designated to remain.
C. Protect bench marks and survey control from damage or displacement.

3.4 CLEARING AND GRUBBING

A. The designated construction area shall be cleared of all trees, brush, shrubbery, and plants, not indicated on Drawings to be preserved. Trees and brush designated to be left in place shall be carefully trimmed as directed and shall be protected from scarring, barking or other injuries during construction operations. Pruned limbs over 2 inches in diameter shall be treated by painting the exposed ends with an approved asphaltic material. Stumps, roots, and other objectionable material shall be removed from areas requiring fill or from borrow sites and/or materials sources to the complete extent necessary to prevent objectionable matter from becoming mixed with the material to be used on construction.
B. Unless otherwise provided, all merchantable timber removed as previously specified shall become the property of the Contractor. It is the intent of this specification to provide for the removal and disposal of all obstructions and objectionable materials not specifically provided for elsewhere by the Contract Documents.
C. Remove existing concrete and asphalt paving, curb, gutter, and existing storm sewer pipe as shown or described to be removed on the Drawings.
D. Remove trees, shrubs and other plant life within the site shown on the Drawings. Remove tree and shrub stumps and root system to a depth of 24 inches below existing grades. Remove grass and ground cover root system to a depth of 6 inches.

3.5 DEBRIS REMOVAL

A. Removed material shall become the property of the Contractor. Contractor shall remove debris, rock, and extracted plant life from site and legally dispose.

3.6 EROSION CONTROL

A. Provide erosion control measures necessary to maintain site. Protect against both wind and rainfall erosion.
B. Reference Section 01 5713 for more specific requirements for erosion control.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 31 2000
EXCAVATION, BACKFILL, AND GRADING FOR SITE WORK OUTSIDE OF BUILDING

PART 1 - GENERAL

1.1 SUMMARY

This section includes:

A. The furnishing of all labor, materials and equipment to complete all demolition, excavation, filling, and compacting; to provide protection of embankments and cuts; and, to remove and dispose of all surplus materials and debris; as required. The work included in this Section is limited to the area defined in the drawings.
B. Quality Assurance.
C. Materials.
D. Excavation.
E. Filling Areas Outside Building.
F. Grading.
G. Non-treated Subgrade Preparation.
H. Trench Backfill.
I. Sheeting, Shoring and Bracing
J. Testing and Laboratory Service.

1.2 REFERENCE SPECIFICATIONS

A. All work covered in this section shall be governed by the latest edition of City of Lucas Specifications and Standard Details as amended and/or supplemented by these specifications. These Specifications and Special Provisions govern the reference specification. Any item not modified or amended by these specifications shall be deemed correct in the reference specifications.
B. Work not described herein or in the City of Lucas Standard Specifications shall be governed by the Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges.

1.3 QUALITY ASSURANCE

A. Lines and Grades: Construction lines and grades shall be established at the site by a competent surveyor or engineer employed by the Contractor. Any additional staking shall also be provided by the Contractor.
B. Subsurface Data: Logs of borings represent only the conditions at the point of the boring at the time the boring was made. Copies of the log of borings, if available, are furnished for general information only. The data given may or may not correspond to the conditions encountered by the Contractor, and minor variation will not be used as a basis for a claim of changed conditions.
C. Debris and Unsuitable Materials: Remove debris, vegetation, rubbish and other perishable or objectionable matter. Dispose of debris and unsuitable materials off-site.
D. With the assistance of the Owners Testing Laboratory, determine areas where soft fill material is located and rework this material as required to prepare a firm stable base for pavement placement.

PART 2 - PRODUCTS

2.1 GENERAL

A. This part shall include the furnishing of all materials of the dimensions and types as shown on the Drawings or as specified.

2.2 MATERIALS

A. Clay Fill: Suitable, clean material excavated on-site or off-site may be used as fill material. Suitable material shall consist of clay soils classified as SC and CL according to the unified soil classification system. Clay soil used for backfill shall be native material.
B. Granular Material: Shall be a graded, well draining material conforming to fine aggregate as described in ASTM C-33-85.
C. On-site Soils: All on-site soils used for construction shall be free of debris such as bricks, concrete, steel, wood and other vegetative matter, asphalt, plastic, etc.
D. Debris: Stumps, limbs, vegetable matter, trash, rubbish, and otherwise objectionable material encountered in excavating shall become the property of the Contractor and shall be disposed of off-site.
E. Materials shall also conform to those described in the Geotechnical Investigation prepared for this project by Alpha Testing, Inc. dated May 13, 2013, Report No. G130650.

PART 3 - EXECUTION

3.1 GENERAL

A. This part shall include the placing of all specified materials at the locations and elevations as shown on the Drawings.

B. The work performed hereunder shall conform in every respect to the Contract Documents, applicable City and State requirements, applicable local ordinances, and regulations of the Occupational Safety and Health Administration (OSHA). In the event that the Contract Documents do not adequately specify materials, methods of construction, or workmanship of any portion of the proposed work, the NCTCOG Standard Specifications for Public Works Construction, as amended in the Contract Documents, shall apply.

C. Fill material for areas outside building may be obtained from borrow area described in the Owner's geotechnical report and as shown on the drawings.

3.2 EXCAVATION

A. All excavation shall be made in such manner as to permit all surfaces to be brought to final line and grade within plus or minus 0.1 foot. Over excavation shall be restored by the Contractor at his own expense. Finished grades consistently high or low will not be acceptable and shall be corrected by the Contractor at his expense.

B. Unsuitable, soft or yielding material present at pavement subgrade shall be removed to a minimum depth of 5 feet below finish subgrade elevations or to a depth determined by the Owner, depending on the type of material removed. Finished subgrade for paving areas shall be proof rolled with a heavy (10 ton) pneumatic tired roller to determine location of soft spots. Soft areas shall be removed and reworked to meet project requirements.

C. Finished subgrade shall be inspected by the Owner's on-site geotechnical/testing laboratory for determination that subgrade meets project specifications. Provide reports certifying that subgrades meet project specifications.

D. Utility trench excavation shall conform to applicable trench excavation protection and safety requirements.

3.3 FILLING AREAS OUTSIDE BUILDING PAD

A. Fills shall be constructed as required to meet the lines and grades indicated on the Drawings. If rock cuttings are used, they shall be broken or crushed so that the maximum dimension is 4 inches. All rock is to be used in the bottom of fills. No rocks will be allowed in the upper 24 inches of the fill.

B. Equipment for compacting fills shall be sheepsfoot rollers, rubber-tired rollers and other Owner-approved equipment capable of obtaining required density.

C. The combined excavation and fill placing operating shall be such that the material when compacted in the fill will be blended sufficiently to secure the best practicable degree of compaction. The suitability of the materials shall be subject to approval of the testing laboratory. Successive loads of material shall be dumped, then spread and mixed to give a horizontal layer of not more than 8 inches in depth, loose measurement. After each layer of fill has been spread to the proper depth it shall be thoroughly manipulated with a disc plow or other suitable and approved equipment until the material is uniformly mixed, pulverized and brought to a uniform approved moisture content.

D. All filling shall be made in such a manner as to permit all surfaces to be brought to final line and grade within plus or minus 0.1 foot. Finished grades consistently high or low will not be acceptable and shall be corrected by the Contractor.

E. Any material, whether undisturbed in place or fill, having a moisture content too high for proper compaction shall be dried by aeration until the moisture content is lowered to a point where satisfactory compaction may be obtained. If the moisture of the fill material is too low, water shall be added to the material, and the material shall be thoroughly mixed by blading and discing to produce a uniform and satisfactory moisture content.

F. If, in the opinion of the testing laboratory, the rolled surface of any layer or section of the fill is too smooth to bond properly with the succeeding layer or adjacent section, the surface shall be roughened by discing or scarifying to the satisfaction of the testing laboratory before placing succeeding layers or adjacent sections.

3.4 GRADING

A. All excavated or filled areas shall be brought to final line and grade by finish grading, paving, or placement of surface materials. Grades not otherwise shown shall be uniform levels or slopes between elevation points, and conforming to adjacent graded areas. In areas requiring clay fill

material, the material shall be placed and compacted in evenly distributed layers, each layer 8 inches or less in depth before compaction and grading. The compaction requirement for general site fill shall be 95% of maximum density at a maximum of +3 percentage points above the soil's optimum moisture content as determined by ASTM D-698 (Standard Proctor Density), or as directed by the on-site geotechnical/testing laboratory for specific types of material. In general, areas adjacent to roads, structures, or other finished surfaces shall be graded to provide positive drainage to drainage collection facilities.

B. Grades shown on plans are finished grades. Contractor shall coordinate proper placement of 4 inches of topsoil in areas requiring topsoil. Contractor shall also coordinate proper subgrade elevations required to achieve finish grades. Topsoil material shall conform to the requirements of the contract documents.

3.5 NON-TREATED SUBGRADE PREPARATION

A. All subgrade under walks and other areas where lime or other treatment is not described shall be prepared by scarifying the top six (6) inches of the material below finish subgrade elevation with disc plow or other suitable and approved equipment. The moisture content shall be adjusted by wetting or aerating to optimum as determined by the testing laboratory. The material shall then be recompacted to the required density (95% - 98% of optimum) as determined by ASTM D-698 (Standard Proctor Density). Finish subgrade shall be a uniformly graded surface with no loose material such as rocks, clods or other debris present.

3.6 TRENCH BACKFILL

A. Refer to Division 2 - Sitework SECTION 31 2200 - EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES (CIVIL) for utility backfill and embedment.

3.7 SHEETING, SHORING, AND BRACING

A. Trench safety systems, as required, shall be designed and provided by the Contractor and shall conform to applicable trench excavation protection requirements of these contract documents and specifications.

3.8 TESTING AND LABORATORY SERVICE

A. Refer to Division 1 - General Requirements SECTION 01 4000 – QUALITY REQUIREMENTS for requirements of testing and laboratory services.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 31 2200
EXCAVATING, BACKFILL AND GRADING FOR UTILITIES (CIVIL)

PART 1 GENERAL

1.1.1 SUMMARY

This Section includes:

A. Excavating, trenching, backfilling and compacting for drainage, water distribution mains, sanitary sewers, inlets and other utility systems and appurtenances, and the disposal of excess excavated material.

1.3 REFERENCE SPECIFICATIONS

A. All work covered in this section shall be governed by the latest edition of the City of Lucas Standard Specifications and Standard Details as amended and/or supplemented by these specifications. These Specifications and Special Provisions govern the reference specification. Any item not modified or amended by these specifications shall be deemed correct in the reference specifications.

B. Work not described herein or in the City of Lucas Standard Specifications shall be governed by the Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges

C. Project Geotechnical Investigation prepared by Alpha Testing, Inc., dated May 13, 2013, Report No. G130650.

D. City of Lucas drawing details and standard appurtenances for water and wastewater pipe construction.

E. TCEQ requirements for OSSF construction.

1.4 PROTECTION OR REMOVAL OF UTILITY LINES

A. The Contractor shall anticipate all underground obstructions such as, but not limited to, water mains, gas lines, storm and sanitary sewers, telephone or electric light or power ducts, concrete, and debris. Any such lines or obstructions indicated on the Drawings show only the approximate locations and shall be verified in the field by the Contractor. The Engineer will endeavor to familiarize the Contractor with all known utilities and obstructions, but this shall not relieve the Contractor from full responsibility in anticipating all underground obstructions whether or not shown on the Drawings.

B. The Contractor shall, at his own expense, maintain in proper working order and without interruption of service all existing utilities and services which may be encountered in the work, except that with the consent of the Architect, Utility Owner and Owner, such service connections may be temporarily interrupted to permit the Contractor to remove designated lines or to make temporary changes in the locations thereof as will aid in the completion of the work and at the same time maintain service to the property so originally benefited. The cost of making any temporary changes shall be at the Contractor's expense.

C. Before starting construction, the Contractor shall notify all utility companies involved to have their utilities located and marked in the field. All underground utilities shall then be uncovered to verify location and elevation before construction begins. The Contractor shall obtain all necessary permits.

PART 2 - PRODUCTS

2.1 EARTH BACKFILL

A. Suitable clean material excavated on site consisting of clay soils classified as SC or CL according to the Unified Soil Classification System may be used as backfill. Clay soil used shall have a liquid limit of less than 60%. Earth Backfill shall be free of lumps, stones, trash and spongy or otherwise objectionable material, inclusive of materials with a plasticity index of 20 or greater, as approved. Approved backfill material may be from the excavation or borrowed.

2.2 GRANULAR MATERIAL

A. Granular material shall be free flowing, such as sand or hydraulically graded crushed stone fines, or mixed sand and gravel, or sandy loam. The material shall be free from lumps, stones over 1 1/2-inch in diameter, clay and organic material.

2.3 CRUSHED STONE

A. The aggregate shall consist of durable particles of crushed stone; free from foreign material or injurious amounts of salt, alkali, vegetable matter or other material.

B. When tested by standard laboratory methods, it shall meet the following requirements for percentage by weight as stated by TxDOT.
   1. Fine Crushed Rock - Aggregate: Grade 8.
   2. Retained on 1/2-inch sieve: 0%
   3. Retained on 3/8-inch sieve: 0%-5%
   4. Retained on No. 4 sieve : 35%-60%
   5. Retained on No. 6 sieve : 90%-100%

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

A. Examine utility routes and coordinate excavation work to eliminate installation conflicts.

B. Allow room for stockpiling excavated material and utility construction material during utility construction.

3.2 TRENCH EXCAVATION

A. Procedure: Excavate to indicated or specified depths.
   1. Excavate by open cut, unless directed otherwise.
   2. Do not use excavated material composed of rocks, chunks or clods larger than 4-inches for backfill. Dispose of such material and provide other suitable material for backfill without additional expense.
   3. During excavation, stock pile material suitable for backfilling in an orderly manner far enough from the bank of the trench to avoid overloading, slides or cave-ins.
   4. Grade as necessary to prevent surface water from flowing into trenches or other excavations.
   5. Cut banks of trench as nearly vertical as practical. Remove stones as necessary to avoid point-bearing. Over-excavate wet or unstable soil from the trench bottom to permit construction of a more stable bed for pipe. Over excavation shall be filled and tamped with clean dry sand or other approved material to the required grade.
   6. Dig the trench the proper width as shown. If the trench width below the top of pipe is wider than specified in this Section or shown on Drawings, then install additional approved material. No additional payment will be made.
   7. Accurately grade the trench bottom to provide proper bedding as required for pipe installation.
   8. If any excavation is carried beyond the lines and grades required or authorized, the Contractor shall, at his own expense, fill such space with concrete or other approved material. No additional payment will be made.

B. Sheeting and Bracing: Install sheeting and bracing necessary to support the sides of trenches and other excavations with vertical sides, as required by General Conditions.

C. Pipe Zone: The pipe zone is defined as including the pipe bedding to one-half the pipe diameter (the springline) and the initial backfill to 6 inches above the top of the pipe.

D. Water in Excavation: Keep work free from ground or surface water at all times. Provide pumps of adequate capacity or other approved method to remove water from the excavation in such a manner that it will not interfere with the progress of the work or the proper placing of other work. Ground or surface water will not be allowed to drain into or be pumped into an existing sanitary sewer system. If the work includes connection to an existing sanitary sewer, coordinate this connection with other work and do not endanger adjacent work or existing features with trench excavations. Trench excavations shall not encroach within the area below a footing defined by a 1:1 slope away from the bottom corner of any footing.

3.3 UTILITY INSTALLATION

A. Sanitary Sewers: Limit clear space on either side of the pipe to 12-inches at and below the top of the pipe or as specified by City of Lucas Details. Above the pipe, cut as wide as necessary to sheet and brace and properly perform the work. Provide Class B-2 bedding as specified in Part 1.4-D, above. Install piping and appurtenances as specified in Section 221313 – Facility Sanitary Sewers.

B. Water Supply and Distribution Lines: Grade trenches to avoid high points requiring vacuum and relief valves in water lines. Provide a minimum cover of 4-feet over the top of the pipe or as indicated on the Drawings. Avoid interference of water lines with other utilities. Provide class B+

bedding as specified in Part 1.4-D, above. Install piping and appurtenances as specified in SECTION 332100 - WATER SYSTEMS.

C. Gas Distribution Lines: Provide cover over the top of the pipe as indicated on the Drawings. Avoid interference with other utilities. Install piping as specified in specification section for Natural Gas Distribution System.

D. Electrical and Telephone System: Trench banks for concrete duct lines need not be kept vertical but may be sloped or widened to such general limits as may be set, provided there is no interference with other utilities.

E. Storm Sewer Culverts: Grade trenches to the line and grade required for proper installation of the pipe. Provide bedding as specified in plan details. Install piping and appurtenances as specified in Section 33 4100 – Storm Drainage Pipe and Appurtenances.

F. Excavation for Appurtenances: Excavate sufficiently for inlets to leave at least 2 feet clear between the outer surfaces and the embankment or timber that may be used to hold and protect the banks. Any over-depth excavation below such appurtenances not directed will be considered unauthorized and will be refilled with cement-sand or concrete, as approved, at no additional cost to the Owner.

3.4 BACKFILLING

A. Criteria: Do not backfill trenches to a point greater than 2 feet above top of pipe until all required pressure tests are performed and utility systems as installed conform to specified requirements of appropriate sections. Backfill trenches to ground surface with material as specified. Reopen trenches improperly backfilled to depth required for proper compaction. Refill and recompact as specified, or otherwise correct the condition in an approved manner.

B. Open Areas:

1. In the pipe zone, place bedding material evenly and carefully around, and over pipe in lifts no thicker than 6 inches. Compact with mechanical hand tampers until there is a cover of not less than 6 inches over utility lines. Use bedding and backfill material as scheduled for in these specifications. Take special care not to damage pipe wrapping or coating.
2. Above the pipe zone, deposit earth backfill in 8-inch lifts. Compact each lift to 95-100% maximum dry density according to ASTM D698 at optimum to +3 percent of optimum moisture content.
3. All forms, lumber, trash and debris shall be removed from trenches, and other utility structures. Backfill for utility structures shall be placed symmetrically on all sides in lifts no thicker than 8-inches. Each lift shall be compacted to 95% dry density according to ASTM D698.

C. Pavement Sections:

1. In the pipe zone, place bedding material as described above.
2. Above the pipe zone, deposit and compact earth backfill in 8-inch lifts as described above.

3.5 TEST FOR DISPLACEMENT OF SANITARY SEWERS

A. All plastic pipe shall be tested for deflection by pulling a mandrel with an outside diameter equal to 95% of the original inside diameter of the pipe through the pipe after backfilling is complete. Mandrel shall be pulled by hand line. Should the mandrel meet any resistance, the Contractor shall clean the line, or correct the resistance, and repeat the test. Any pipe not meeting this test shall be removed and installed, or replaced if damaged.

3.6 DISPOSAL OF EXCESS MATERIAL

A. Excess Excavated Material (soil material free of trees, stumps, logs, brush, roots, rubbish and other objectionable matter which has been approved). Remove excess excavated material from the construction site before Pre-final Inspection. Approved excess material shall be deposited on the Owner's property in an approved location.

B. Waste Material (soil material including trees, stumps, logs, brush, roots, rubbish and other objectionable matter which has not been approved). Remove waste material from the project site before Pre-final Inspection. Legally dispose of material at a licensed site or with written and notarized permission from the property owner for a private disposal site. All costs associated with waste material removal and disposal shall be paid for by the Contractor.

3.7 TESTING

A. Laboratory Testing and Inspection Services shall conform to the requirements described in Division 1 - General Requirements - SECTION 01 4000.

END OF SECTION

SECTION 31 2300
EXCAVATING, BACKFILLING AND COMPACTING FOR PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

This section includes

A. Excavating, backfilling and compacting for establishing pavement subgrade elevations.

1.2 REFERENCE SPECIFICATIONS

A. All work covered in this section shall be governed by the latest edition of the City Lucas Standard Specifications and Standard Details as amended and/or supplemented by these specifications. These Specifications and Special Provisions govern the reference specification. Any item not modified or amended by these specifications shall be deemed correct in the reference specifications.

B. Work not described herein or in the City of Lucas Standard Specifications shall be governed by the Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges.

C. Project Geotechnical Investigation prepared by Alpha Testing Inc. dated May 13, 2013 Report No. G130650.

D. City of Lucas drawing details and standard appurtenances for water and wastewater pipe construction methods.

1.5 EXISTING UTILITIES

A. Where pipes, ducts and structures are encountered in the excavation but are not shown on the Drawings, immediately notify the Architect.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Clay Fill: Suitable, clean material excavated on-site or off-site may be used as fill material. Suitable material shall consist of clay soils classified as SC and CL according to the unified soil classification system. Clay soil used as fill shall have a liquid limit of less than 60% and a Plasticity Index between 20 and 35.

B. Granular Material: Shall be a graded, well drainage material conforming to fine aggregate as described in ASTM C-33-85.

C. On-site Soils: All on-site soils used for construction shall be free of debris such as bricks, concrete, steel, wood and other vegetative matter, asphalt, plastic, etc.

D. Debris: Stumps, limbs, vegetable matter, trash, rubbish, and otherwise objectionable material encountered in excavating shall become the property of the Contractor and shall be disposed of off-site.

E. Materials shall also conform to those described in the Geotechnical Investigation prepared for this project by **Alpha Testing, Inc. Report No. G130650 dated May 13, 2013**

PART 3 - EXECUTION

3.1 EXCAVATION

A. Objective: As shown on the Drawings, excavate to lines, grades and elevations required for subsequent construction of embankments, prepared subgrade, or pavement. Remove materials within the indicated limits and dispose as directed.

B. Drainage: During excavation, maintain grades for complete drainage. When directed, install temporary drains or drainage ditches to intercept or divert surface water and prevent interference or delay of the work.

C. Stockpiling: If at time of excavation it is not possible to place material in the proper section of permanent construction, stockpile the material in approved areas for later use.

D. Stone or Rock: Stones or rock fragments larger than 1-inches in their greatest dimension will not be permitted in top 6 inches of subgrade.

E. Dressing: Uniformly dress cut and fill slopes to slope, cross section and alignment, as shown.

3.4 NATURAL SUBGRADE UNDER PAVEMENTS

A. Remove existing earth as required for placement of pavement section as indicated on the Drawings. Proof roll excavated surface with a 25 ton or larger roller to identify soft or undesirable material and remove such soft or undesirable material to suitable material beneath. Break down sides of holes or depressions to flatten the slopes.

B. Fill any such hole or depression with appropriate soil with similar classification, moisture content, and density as adjacent soils.
C. Grade adjustments within pavement construction limits shall be accomplished with fill material, placed in maximum 6-inch lifts moistened and compacted as specified in this Section.
D. After depressions have been filled, grade adjustments made, and immediately before placement of pavement section, thoroughly loosen the foundation material to a depth of 8 inches. Remove roots and debris turned up while loosening the soil. Adjust moisture and recompact the subgrade as specified in this Section.

3.5 PLACING EMBANKMENT FILL FOR GRADE ADJUSTMENTS

A. Inspection of Natural Subgrade: Proof roll excavated surface with a 25 ton or larger roller to identify soft or undesirable material and remove such soft or undesirable material to suitable material beneath. Any soft or compressible areas detected during the recompaction process shall be undercut such that sound subgrade soils are exposed and recompacted. Do not place fill for grade adjustments to the natural subgrade until the surface has been approved.
B. Prior to placing fill, scarify the natural subgrade to a depth of 6 inches. As needed, adjust the moisture content to between to the recommended level. Recompact the subgrade to a minimum dry density of 95% of the maximum Standard Proctor Density, as determined by ASTM D698. Moisture content shall conform to that required by Owners Testing Laboratory for the type of material used.
C. Removing Debris: During the dumping and spreading process, remove all roots, stones, and debris that are uncovered in the select material.
D. Spreading Fill: After dumping, spread the pavement fill in horizontal layers over the entire fill area. The thickness of each layer before compaction shall not exceed 8 inches and compact to the moisture/density values specified above. Place fill adjacent to pavement sections to elevations indicated.
E. Attaining Proper Bond: If the compacted surface of a layer is too smooth to bond with succeeding layers, loosen the surface by harrowing or other approved method before continuing the work.

3.6 MOISTURE CONTROL

A. Intent: Developing the maximum density obtainable with the natural moisture of the material is preferred. However, the moisture content of the fill material shall not vary from the optimum, as determined by ASTM D698, except as allowed by the Owners Testing Laboratory. The moisture content of the natural subgrade under pavement sections, including grade adjustments with fill, as determined by ASTM D698 shall be maintained near optimum.
B. Adjustment: If the moisture content is too high, adjust to within the specified limits by spreading the material and permitting it to dry. Assist the drying process by discing or harrowing if necessary. When the material is too dry, sprinkle each layer with water. Work the moisture into the soil by harrowing or other approved method.

3.7 COMPACTION

A. Compact each layer of pavement select fill with suitable rollers as necessary to obtain a minimum dry density of 95% of the maximum dry density within the specified range (optimum - +3%) of the moisture content, according to ASTM D698.

3.8 MATERIAL DISPOSAL

A. Excess Excavated Material: Soil material free of trees, stumps, logs, brush, roots, rubbish and other objectionable matter which has been approved. Remove excess excavated material from the construction site before Pre-final Inspection. Approved excess material shall be deposited on the Owner's property in an approved location.
B. Waste Material: Soil material including trees, stumps, logs, brush, roots, rubbish and other objectionable matter which has not been approved. Remove waste material from the project site before Pre-final Inspection. Legally dispose of material at a licensed site or with written and notarized permission from the property owner for a private disposal site. All costs associated with waste material removal and disposal shall be paid for by the Contractor.

3.9 TESTING AND LABORATORY SERVICE

A. Refer to Division 1 - General Requirements - 01 4000 – QUALITY REQUIREMENTS for requirements of testing and laboratory services.

END OF SECTION

SECTION 31 6329
DRILLED CONCRETE PIERS AND SHAFTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Dry-installed drilled piers.

B. Related Sections:
   1. Section 013200 "Construction Progress Documentation" for recording preexisting conditions and drilled-pier progress.
   2. Section 015000 "Temporary Facilities and Controls."
   3. Section 311000 "Site Clearing" for preparation of subgrade for drilled-pier operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface.

1.3 UNIT PRICES

A. Unit prices are included in Section 012200 "Unit Prices."

B. Drilled Piers: Actual net volume of drilled piers in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments will be made on net variation of total quantities, based on design dimensions for shafts and bells.
   1. Base bids on indicated number of drilled piers and, for each pier, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
   2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-pier installation.

C. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed outside dimensions of drilled piers cast against rock. Unit prices for rock excavation include replacement with approved materials.

1.4 ACTION SUBMITTALS

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

B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Shop Drawings: For concrete reinforcement detailing fabricating, bending, supporting, and placing.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and testing agency.

B. Welding certificates.

C. Material Certificates: For the following, from manufacturer:
   1. Cementitious materials.
   2. Admixtures.
   3. Steel reinforcement and accessories.

D. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates.

E. Field quality-control reports.

F. Other Informational Submittals:
   1. Record drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in drilled-pier work.

B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

C. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.4, "Structural Welding Code - Reinforcing Steel."

D. Drilled-Pier Standard: Comply with ACI 336.1 unless modified in this Section.

E. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to drilled piers including, but not limited to, the following:
   a. Review geotechnical report.
   b. Discuss existing utilities and subsurface conditions.
   c. Review coordination with temporary controls and protections.

1.7 PROJECT CONDITIONS

A. Existing Utilities: Locate existing underground utilities before excavating drilled piers. If utilities are to remain in place, provide protection from damage during drilled-pier operations.

1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.

B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Construction Manager no fewer than two days in advance of proposed interruption of utility.
2. Do not proceed with interruption of utility without Construction Manager's written permission.

C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for drilled piers.
2. The geotechnical report is included elsewhere in the Project Manual.

D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled piers. Before excavating, lay out each drilled pier to lines and levels required. Record actual measurements of each drilled pier's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.

1. Record and maintain information pertinent to each drilled pier and cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.

C. Galvanized Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, ASTM A 767/A 767M, zinc coated after fabrication and bending.

D. Epoxy-Coated Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, ASTM A 775/A 775M or ASTM A 934/A 934M, epoxy coated, with less than 2 percent damaged coating in each 12-inch (300-mm) bar length.

E. Plain-Steel Wire: ASTM A 82, as drawn.

F. Deformed-Steel Wire: ASTM A 496.

G. Epoxy-Coated Wire: ASTM A 884/A 884M, Class A, Type 1 coated, as-drawn, plain-steel wire, with less than 2 percent damaged coating in each 12-inch (300-mm) wire length.

H. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain. Cut bars true to length with ends square and free of burrs.

2.2 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
   1. Portland Cement: ASTM C 150, Type I/II. Contractor may supplement with the following:
      a. Fly Ash: ASTM C 618, Class C or Class F.

B. Normal-Weight Aggregate: ASTM C 33, graded, 1-1/2 inch nominal maximum coarse-aggregate size. Provide aggregate from a single source.
   1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: ASTM C 94/C 94M and potable.

D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

E. Sand-Cement Grout: Portland cement, ASTM C 150, Type II; clean natural sand, ASTM C 404; and water to result in grout with a minimum 28-day compressive strength of 1000 psi (6.9 MPa), of consistency required for application.

2.3 STEEL CASINGS

A. Steel Pipe Casings: ASTM A 283/A 283M, Grade C, or ASTM A 36/A 36M, carbon-steel plate, with joints full-penetration welded according to AWS D1.1/D1.1M.

B. Corrugated-Steel Pipe Casings: ASTM A 929/A 929M, steel sheet, zinc coated.

C. Liners: Comply with ACI 336.1.

2.4 CONCRETE MIXTURES

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 limits as if concrete were exposed to deicing chemicals.

C. Limit water-soluble, chloride-ion content in hardened concrete to [0.15] [0.30] percent by weight of cement.

D. Proportion normal-weight concrete mixture as follows:
   1. Compressive Strength (28 Days): 3000 psi (20.7 MPa.
   2. Maximum Water-Cementitious Materials Ratio: 0.50.
   3. Minimum Slump: Capable of maintaining the following slump until completion of placement:
      a. 4 inches (100 mm) for dry, uncased, or permanent-cased drilling method.
      b. 6 inches (150 mm) for temporary-casing drilling method.
   4. Air Content: Do not air entrain concrete.

2.5 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.6 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
   1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-pier operations.

3.2 EXCAVATION

A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
   1. Obstructions: Unclassified excavation may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. No changes in the Contract Sum or the Contract Time will be authorized for removal of obstructions.
   2. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work will be according to Contract provisions for changes in the Work.

B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

C. Excavate shafts for drilled piers to indicated elevations. Remove loose material from bottom of excavation.
   1. Excavate bottom of drilled piers to level plane within 1:12 tolerance.
   2. Remove water from excavated shafts before concreting.
   3. Excavate rock sockets of dimensions indicated.

D. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled piers as determined by Architect.
   1. Do not excavate shafts deeper than elevations indicated unless approved by Architect.
   2. Payment for additional authorized excavation will be according to Contract provisions for changes in the Work.

E. End-Bearing Drilled Piers: Probe with auger to a depth below bearing elevation, equal to diameter of the bearing area of drilled pier. Determine whether voids, clay seams, or solution channels exist.
   1. Test first three drilled piers and one of every six drilled piers thereafter.
   2. Fill augur-probe holes with grout.

F. Excavate shafts for closely spaced drilled piers and for drilled piers occurring in fragile or sand strata only after adjacent drilled piers are filled with concrete and allowed to set.

G. Temporary Casings: Install watertight steel casings of sufficient length and thickness to prevent water seepage into shaft; to withstand compressive, displacement, and withdrawal stresses; and to maintain stability of shaft walls.
   1. Remove temporary casings, maintained in plumb position, during concrete placement and before initial set of concrete.

H. Tolerances: Construct drilled piers to remain within ACI 336.1 tolerances.
   1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit design and construction proposals to Architect for review before proceeding.

3.3 STEEL REINFORCEMENT

A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by Owner's independent testing and inspecting agency.
   1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete[and insert joint dowel bars]. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.

B. Dry Method: Place concrete to fall vertically down the center of drilled pier without striking sides of shaft or steel reinforcement.
   1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
   2. Vibrate top 60 inches (1500 mm) of concrete.

C. Coordinate withdrawal of temporary casings with concrete placement to maintain at least a 60-inch (1500-mm) head of concrete above bottom of casing.
   1. Vibrate top 60 inches (1500 mm) of concrete after withdrawal of temporary casing.

D. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.

E. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
   1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.

F. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F (32 deg C).
   1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Drilled piers.
   2. Excavation.
   3. Concrete.

B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Drilled-Pier Tests and Inspections: For each drilled pier, before concrete placement.
   1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled piers indicated have been estimated from available soil data. Actual elevations and drilled-pier lengths and bearing capacities will be determined by testing and inspecting agency. Final evaluations and approval of data will be determined by Architect.

D. Concrete Tests and Inspections: ASTM C 172 except modified for slump to comply with ASTM C 94/C 94M.
   1. Slump: ASTM C 143/C 143M; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
   2. Concrete Temperature: ASTM C 1064/C 1064M; 1 test hourly when air temperature is 40 deg F (4.4 deg C) and below and 80 deg F (27 deg C) and above, and 1 test for each set of compressive-strength specimens.
   3. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens unless field-cured test specimens are required.
   4. Compressive-Strength Tests: ASTM C 39; one set for each drilled pier but not more than one set for each truck load. One specimen will be tested at 7 days, 2 specimens will be tested at 28 days, and 1 specimen will be retained in reserve for later testing if required.

5. If frequency of testing will provide fewer than five strength tests for a given class of concrete, testing will be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
6. If strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
7. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
8. Report test results in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests: Testing and inspecting agency will make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
    a. Continuous coring of drilled piers may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
11. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

E. An excavation, concrete, or a drilled pier will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports for each drilled pier as follows:
1. Actual top and bottom elevations.
2. Actual drilled-pier diameter at top, bottom, and bell.
3. Top of rock elevation.
4. Description of soil materials.
5. Description, location, and dimensions of obstructions.
6. Final top centerline location and deviations from requirements.
7. Variation of shaft from plumb.
8. Shaft excavating method.
9. Design and tested bearing capacity of bottom.
10. Depth of rock socket.
11. Levelness of bottom and adequacy of cleanout.
12. Ground-water conditions and water-infiltration rate, depth, and pumping.
13. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
14. Description of soil or water movement, sidewall stability, loss of ground, and means of control.
15. Bell dimensions and variations from original design.
16. Date and time of starting and completing excavation.
17. Inspection report.
18. Condition of reinforcing steel and splices.
19. Position of reinforcing steel.

20. Concrete placing method, including elevation of consolidation and delays.
21. Elevation of concrete during removal of casings.
22. Locations of construction joints.
23. Concrete volume.
24. Concrete testing results.
25. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 321216
PORTLAND CEMENT CONCRETE PAVING (CIVIL)

PART 1 – GENERAL

1.1 SUMMARY

This section includes:

A. Concrete pavement for vehicular traffic.
B. Concrete site paving.
C. Concrete curb and gutter.

1.2 REFERENCE SPECIFICATIONS:

A. All work covered in this section shall be governed by the latest edition of the Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highway, Street and Bridges as amended and/or supplemented by these specifications. These Specifications and Special Provisions govern the reference specification. Any item not modified or amended by these specifications shall be deemed correct in the reference specifications.
B. Project Geotechnical Investigation prepared by Alpha Testing Inc. dated May 13, 2013 Report No. G130650.

1.3 SUBMITTALS:

A. Product Data: Manufacturer's product data sheets for joint fillers and sealers.
B. Concrete Mix Design: Submit mix designs in accordance with submittal requirements specified in TxDOT Item 360.

1.6 QUALITY ASSURANCE:

A. Concrete Mix Design Criteria: Provide concrete mix designs in accordance with requirements specified in TxDOT Item 360.

1.7 PROJECT CONDITIONS:

A. Environmental Requirements: Do not place concrete during rain, sleet or snow unless protection is provided. Maintain concrete temperatures as follows:
B. Cold Weather: Maximum and minimum, ASTM C94.
C. Hot Weather: Maximum 90°F.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Concrete: As indicated on plans.
B. Reinforcing Steel: As indicated on plans.
C. Forms: Nominal 2 in. thickness dimension lumber, except use steel paving forms, TxDOT Item 360 if concrete spreader or slipform paver equipment is used.
D. Expansion joint material shall be redwood boards, 3/4-inch in width and extended through curbs.
E. Dowels and Sleeves: Smooth round bars, with sleeves at one end, allowing one inch of movement.
F. Joint Sealer: ASTM D1190, hot-poured elastomeric type or ASTM D1850, cold-applied type.

2.2 MIXING:

A. Mixing: Ready mixed concrete in accordance with ASTM C94.
B. Slump: Not less than 1-1/2 nor more than 3 in., ASTM C143.

2.3 EQUIPMENT:

A. At Contractor's option, subgrade planer and template, concrete spreader or slipform paver, mechanical vibratory equipment and finishing equipment may be used for placing and finishing vehicular concrete paving, TxDOT Item 360.

2.4 SOURCE QUALITY CONTROL:

A. Laboratory testing and inspection of concrete batching at ready mix plant as specified in Section 01 4000.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine sub-grade for conditions that would prevent proper placement of concrete.
B. Verify that sub-grade has been prepared, shaped and compacted as specified in TxDOT Item 260.
C. Verify that sub-grade compaction and base courses have been satisfactorily completed.
D. Do not place concrete until conditions are free of defects.

3.2 FORMWORK:

A. Build forms to lines and grades detailed, of sufficient strength and rigidity so they will not deflect under pressure of wet concrete.

B. Exercise extreme care in laying out, bracing and aligning forms. Formwork shall be straight, with no deviations in completed work greater than 1/4 in. in 10 feet.

C. Construct steel paving forms, if used, in accordance with TxDOT Item 360.

3.3 REINFORCING:

A. Place reinforcing steel of sizes, shapes, lengths and spacing as detailed or scheduled.

B. Support reinforcing on metal chairs or spacers (not wood blocks or brick bats) to provide a minimum of 2" clearance or as shown in typical pavement details.

C. Place dowels and sleeves at expansion joints in vehicular and other paving at spacing shown in plan details.

3.4 PLACING:

A. Vehicular Paving: In accordance with TxDOT, Item 360.

B. Concrete: Convey and place concrete so there is no separation of ingredients in accordance with applicable requirements of Section 03 3000 and TxDOT, Item 360. Do not place concrete when temperature is below 40° F.

C. Stoppage of concrete placing shall occur at expansion joints or other detailed contraction joints.

D. Construct bulkheads to permit continuation of reinforcing steel.

E. When stoppage occurs at a control joint, treat as a construction joint.

3.5 JOINTING:

A. Expansion Joints: Place expansion joints at locations detailed and scheduled. Place joint filler in expansion joint, 3/4 in. width at paving. Provide removable tacked-on strips to provide a recess for joint sealing compound or joint sealant.

B. Construction Joints: Provide construction joints at end of each day's work or when concrete placement is stopped more than 1/2 hour. At each construction joint form a troweled control joint with 1/4 in. maximum edge radius.

C. Provide construction joints at end of each day's work or when concrete placement is stopped more than 1/2 hour.

D. Formed Control Joints:

1) Space joints as shown on Drawings.
2) Form joints with joint forms placed while concrete is still plastic.
3) Joint forms shall extend 1/5 of slab thickness

E. Saw-Cut Control Joints: Saw-cut joints where shown on Drawings within 18 hours after placing concrete, using a power-driven concrete saw. Provide a clean, smooth cut, producing a groove to the depth and width shown in the standard construction details.

F. Tooled Control Joints: Tool joints evenly to size and depth shown, straight within 1/8 in. in 10 ft.

3.6 CURING:

A. Cure concrete as specified in NCTCOG Item 5.8.2. (i)

3.7 SEALING JOINTS:

A. Remove tack-on strips of expansion joint filler to provide recess for joint seal. Clean and dry joints with compressed air prior to sealing.

B. Joint Sealing:

1. Vehicular and Other Paving: Apply hot or cold joint sealer to expansion joints, control joints and construction joints, filling joints to within 1/8 in. of paving surface.
2. Expansion Joints between Paving and Structures: Self-leveling polyurethane sealant applied according to manufacturers recommendations.

3.8 ADJUSTING AND CLEANING:

A. Backfilling: After curing, remove forms and debris then backfill, grade and compact adjoining area to lines and grades indicated.

B. Cleaning Up: Upon completion of work, clean up work areas by removing debris, surplus material and equipment from site. Sweep paved surfaced clean.

3.9 PROTECTION:

A. Protect paving from stains and damage and restrict vehicular traffic. Replace damaged or stained paving.

3.10 FIELD QUALITY CONTROL:

A. Laboratory Testing and Inspection Services shall conform to the requirements described in Division 1 - General Requirements - SECTION 01 4000.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK

SECTION 329200
GRASS SEEDING FOR SLOPE PROTECTION AND EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Items required for preparing ground, providing for sowing of seeds and fertilizing, mulching with straw, watering, weed control, and other management practices required for erosion control and to obtain a grass cover. Areas requiring seeding for erosion control will include the drainage ditch embankment and all areas disturbed by construction, including the working easement.

1.2 REFERENCE SPECIFICATIONS

A. All work covered in this section shall be governed by the latest edition of the City of Lucas Standard Specifications and Standard Details as amended and/or supplemented by these specifications. These Specifications and Special Provisions govern the reference specification. Any item not modified or amended by these specifications shall be deemed correct in the reference specifications.

B. Work not described herein or in the City of Lucas Standard Specifications shall be governed by the Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Seed shall comply with U.S. Department of Agriculture rules and regulations under the Federal Seed Act.
   2. Bags of fertilizer shall be fully labeled complying with applicable State fertilizer laws and shall bear the name, trade name, trademark, warranty of producer, and analysis of contents.
   3. Planting material shall conform to Texas Department of Transportation requirements.

B. Contractor's Qualifications:
   1. The work of this section shall be performed by a Contractor specializing in seeding and/or landscape installations.
   2. Guarantee all materials to be of quality and quantity as specified herein.

C. Water: For watering plantings, use water free of impurities injurious to plant growth.

1.4 SUBMITTALS

A. Certificates of Conformance or Compliance:
   1. Seed: Type, purity and germination rate analysis.
   2. Fertilizer: Manufacturer's guaranteed analysis.
   3. Hydromulch Fiber: Manufacturer's guaranteed analysis.
   4. Tackifier: Manufacturer's guaranteed analysis.

1.5 PRODUCT HANDLING

A. Seed:
   1. Furnish seed in sealed standard containers.
   2. Seed which has become wet, moldy, or otherwise damaged in transit or in storage shall not be used.
   3. Wet, moldy, or otherwise damaged seed will be rejected and removed from site.

B. Fertilizer: Deliver to site in sealed bags.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Seed: Refer to Planting Schedule this Section.

B. Fertilizer: Complete fertilizer, for use with hydromulch, with minimum 50 percent nitrogen derived from organic sources. The dryweight percentage shall be 18-6-12 (N-P-K), also containing zinc and iron.

C. Wood Cellulose Fiber Mulch:
   1. Specially prepared wood cellulose fiber, for use with hydraulic application of grass seed and fertilizer, processed to contain no growth or germination inhibiting factors, and dyed appropriate color to facilitate visual metering of application of materials. Green is preferable.
   2. Containing not in excess of 10 percent moisture, air dry weight basis.
   3. Fibers become uniformly suspended in slurry tank mixture to form homogeneous slurry.

D. Tackifier: Provide a binding agent to hold mulch, fiber and seed in place. Tackifier shall be water-soluble or shall be capable of remaining in suspension during the application process.

1. Source: Hydro-Tack, N-Tack, or Terra-Tack.

E. Water: Free from oil, acid, alkali, salt and other substances harmful to growth of grass.

PART 3 - EXECUTION

3.1 GENERAL

A. Accomplish seeding and mulching work and seeding and fertilizing work within the planting periods specified in paragraph entitled "Planting Schedule" of this Section.

B. If factors prevail to such an extent that satisfactory results are not likely to be obtained, stop any phase of the work and resume work when desired results are likely to be obtained.

C. Conduct seeding and mulching operations across slope.

3.2 INSPECTION AND TEST

A. Seed:

1. Each lot of seed may be resampled and retested in compliance with latest rules and regulations under Federal Seed Act at discretion of Owner.
2. Make resampling and retesting by or under supervision of Owner.
3. If these tests reveal seed to be below specified pure live seed content, plant additional seed to compensate for deficiency at no additional cost to Owner.
4. Seed retests: Conducted by approved laboratory.
5. Make allowance for actual pure live seed content of specified grasses in determining actual planting rate.

B. Fertilizers:

1. Retain fertilizer bags and upon completion of project, final check of total quantities of fertilizer used will be made against total area treated.
2. If minimum rates of application have not been met, distribute additional quantities of these materials to make up minimum application specified.

C. Mulch: At least five (5) days prior to commencement of mulching operations, notify Owner of sources from which mulch materials are available and quantities thereof.

3.3 SEED BED AND PREPARATION

A. General:

1. Perform seeding after designated areas for seeding and fertilizing have been graded and smoothed to finished lines and grades and typical cross-sections.
2. Equipment necessary for proper preparation of ground surface and for handling and placing required materials shall be on hand and in good condition before work is started.

B. Grading:

1. Maintain grades on areas to be seeded in true and even condition without ruts or tracks.
2. Maintenance shall include any necessary repairs to previously graded area prior to planting of seed.

C. Tillage:

1. Accomplish in such manner as to prepare seed bed.
2. Use tractors with adequate horsepower and heavy duty tillage equipment to accomplish specified tillage operations.
3. Till areas with heavy duty disc, as necessary, followed by discing with disc harrow, and smoothing with weighted spike tooth harrow, railroad irons, or bridge timber float drag.
4. Cultivate seed bed to state of good tilth so that soil particles on surface are small enough and lie close enough together to prevent seed from being covered too deep for optimum germination.
5. Leave areas smooth for ease of mowing.
6. Depth of tillage: 4 inches.

D. Cleanup:

1. Prior to seeding, clear surface of stone, stumps, or other objects larger than 3 inches in thickness or diameter and of roots, brush, wire, grade stakes, and other objects that might be a hindrance to maintenance operations.
2. Mow, rake and remove vegetation that may interfere with operations from site.

3.4 APPLICATION OF FERTILIZER

A. Apply fertilizer simultaneously with seed and mulch in hydraulic equipment using specified rate of application.

3.5 PLANTING SEED

A. General:
   1. Conduct seeding equipment calibration tests as means of determining coverage per load to plant seed at specified rates.
   2. If unplanted skips are noted after germination and growth of grass, seed unplanted areas with grasses that were to have been planted at no additional cost to Owner.

B. Seeding:
   1. Rate of application: Refer to Planting Schedule in this section.
   2. Uniformly plant one-half of total amount of seed to depth of 1/4 inch to 1/2 inch by use of approved grain drills, native grass seed drills, Brillion Cultipacker seeder or equivalent; or by broadcasting seed and harrowing or raking lightly to cover seed.
   3. Spray on other one-half of total amount of seed with hydraulic equipment in combination with fertilizer and mulch.

3.6 APPLICATION OF MULCH

A. Area to be seeded shall first be cultipacked with Brillion Cultipacker or equivalent.

B. Make application of wood cellulose fiber mulch slurry with hydraulic equipment and accomplish immediately upon completion of final tillage.

C. Hydraulically spray slurry on ground to form blotter-like ground cover uniformly impregnated with grass seed which, after application, will allow absorption of moisture and allow rainfall or mechanically applied watering to percolate to underlying soil.

D. Apply wood cellulose fiber mulch at a rate of 50 pounds per 1000 square feet in combination with fertilizer at rate of 10 pounds per 1000 square feet and seed at rate prescribed in paragraph, "Planting Schedule" in this section. Repeat fertilizer (10 pounds per 1000 square feet) in 40 to 65 days.

E. Use hydraulic equipment application of wood fiber mulch having built-in agitation system with operating capacity sufficient to agitate, suspend, and mix homogeneously slurry containing up to 40 pounds of fiber plus combined total of 70 pounds of fertilizer solids for each 100 gallons of water.

F. Slurry Lines: large enough to prevent stoppage.

G. Accomplish application of mulch slurry same day as completion of final tillage.

H. Keep mulch moist by daily application of water, if necessary, for minimum of ten days or until seeds in mulch have germinated and rooted in soil.

3.7 MAINTENANCE OF TURF

A. General:
   1. Contractor is responsible for maintaining areas during planting period and until other work under contract has been completed.
   2. Maintenance shall consist of protection, replanting, maintaining existing grades, and repair of erosion damage.

B. Protection:
   1. Protect seeded and mulched areas against traffic or other use immediately after seeding is completed.
   2. Maintain protection of these areas until completion of work under contract.

C. Replanting:
   1. Prepare, reseed and remulch areas on which less than six live growing grass plants per square foot are present ten days after planting.
   2. Replant as specified for original planting.
   3. Perform replanting required without cost to Owner.

D. Maintenance of Grades and Repair of Erosion Damage:
   1. Contractor is responsible for maintaining grades of slopes after commencement of planting operations and during maintenance period.
   2. Promptly repair any damage to finished surface grades.
   3. Promptly repair damage in the event erosion occurs from rainfall or other causes.
   4. Correct ruts, ridges, tracts, and other surface irregularities and replant areas where required prior to acceptance.

3.8 WATERING AND MAINTENANCE

A. Apply water after compaction and seeding. Apply water using portable pipe or hose lines with rotating sprinklers within 24 hours after seeding. Sprinkling may be done with water trucks and hoses in certain locations where it is impractical to use portable lines or hoses. Supervise sprinkling

to prevent runoff of water. The Contractor shall furnish all pumps, hoses, pipe lines, water trucks and sprinkling equipment required. Water with approved watering equipment in compliance with the schedule of 14,000 gal/acre weekly for 7 weeks, or as required to achieve grass coverage, whichever is greater. Do not water at rates exceeding 5,000 gal/acre/hr., to prevent runoff.

3.9 WEEDING

A. Keep all seeded areas relatively free from weeds and undesirable grasses, using approved methods, materials and timing.

3.10 DISEASE AND INSECT/PEST CONTROL

A. Upon discovery of any disease or insect pest infestation, identify or have identified the nature or species of infestation and submit the proposed method of control for approval prior to application of control measures.

3.11 MOWING

A. Mow the grass should the height reach 3-1/2 inches or greater on the average before final acceptance. Mow to a height of 2-1/2 inches. Mow as required until work is accepted.

3.12 PLANTING SCHEDULE

A. Minimum percentage by weight of pure live seed in each lot of seed shall be as follows: seed planted at rate per acre indicated under pure live seed required per acre. Note: Percent Pure Live Seed = Percent Purity times Percent Germination.

B. Seed shall be treated with fungicide.

C. Weed seed shall not exceed 10 percent by weight of total of pure live seed and other material in mixture.

D. Johnson grass, ragweed, nutgrass or other noxious seed in mixture will be cause for rejection of seed.

OPTIONAL PLANTING PERIOD IF PLANTING IS TO OCCUR 1 FEBRUARY THROUGH 15 MAY

Type of Seed		Minimum Percent Pure Live Seed Required	Pounds Pure Live Seed Required Per Acre
a.	Green Spangletop	85	0.6
b.	Sideoats Grama (Haskell or Premier)	85	1.8
c.	Buffalograss	85	5.3
d.	Little Bluestem	85	1.1
e.	K R Bluestem	85	0.7
f.	Switchgrass (Alamo)	85	1.2
		(Total a + b + c + d + e + f)	10.7

Note: IF PLANTING IS TO OCCUR OUTSIDE OF OPTIMAL PLANTING PERIOD STATED ABOVE, PLANTING PERIOD MAY BE EXTENDED UPON APPROVAL OF OWNER:

END OF SECTION

SECTION 33 4100
STORM DRAINAGE PIPE AND APPURTENANCES

PART 1 - GENERAL

1.1 SUMMARY

This section includes:

A. The furnishing of all labor, material and equipment required for the construction of the storm sewer, complete in place, including, but not limited to, reinforced concrete pipe, PVC pipe, pipe fittings, connections, excavation, embedment and backfill.

1.2 REFERENCE SPECIFICATIONS

A. All work covered in this section shall be governed by the latest edition of the Texas Department of Transportation, 2004 Standard Specifications for Construction of Highways, Streets and Bridges. as amended and/or supplemented by these specifications. These Specifications and Special Provisions govern the reference specification. Any item not modified or amended by these specifications shall be deemed correct in the reference specifications.

PART 2 - PRODUCTS

2.1 GENERAL

A. This part shall include the furnishing of all materials of the dimensions and types as shown on the Drawings or as specified.

2.2 MATERIALS

A. Materials shall be in accordance with the TxDOT 2004 Standard Specifications Item 464, REINFORCED CONCRETE CULVERT.

PART 3 - EXECUTION

3.1 GENERAL

A. This part shall include the placing of all specified materials at the locations and elevations as shown on the Drawings.

B. The work performed hereunder shall conform in every respect to the Contract Documents, applicable City requirements, applicable local ordinances and sanitary codes, regulations of the State Health Department, and regulations of the Occupational Safety and Health Administration (OSHA). In the event that the Contract Documents do not adequately specify materials, methods of construction, or workmanship of any portion of the proposed work, the TxDOT 2004 Standard Specifications, as amended in the Contract Documents, shall apply.

3.2 INSTALLATION

A. Construction methods shall be in accordance with these specifications.

B. Excavation and backfill shall be in accordance with these specifications.

C. Inlets - The inlets shall be constructed to the lines and grades shown on the drawings. If bottoms and tops are constructed separately, rebar shall be extended from bottom to allow tie in with the top.

D. Trench safety systems shall be provided by the Contractor. Trench safety systems shall be designed and sealed by a State of Texas Registered Professional Engineer experienced in the design of trench safety systems and shall comply with all applicable Local, State and Federal regulations. Contractor shall provide a separate unit price for trench safety systems required for this project.

END OF SECTION

THIS PAGE INTENTIONALLY BLANK